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MULTI-RESOURCE ECOSYSTEM MODEL REVIEW :
RESOURCE MANAGEMENT MODELS

by
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**Multi-Resource Ecosystem Model Review:
Resource Management Models**

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Review of Non-timber Resource Management Models

1. Introduction

In recent years, forest pest managers and forest managers in general have expressed a need for developing links between dynamic forest vegetation/forest pest models and non-timber resource management models, which tend to be more static assessments of current forest conditions (Sutherland et al., 1993). It is anticipated that linkage between the two types of models would not only improve the predictive capabilities of resource management models but also enhance pest models by incorporating the impacts of non-timber resource management on pest management.

Toward this end, a review of non-timber resource management models in use by the USDA Forest Service has been conducted. Informal surveys were sent to fire managers, wildlife biologists, hydrologists, soil scientists, recreation managers, and landscape architects through the Agency's Data General (DG) computer network. Those models indicated by survey respondents as most useful or potentially useful were investigated as to their geographic applicability, vegetative links, driving variables, output, type of analysis, levels of computer demand, and potential for adding pest considerations.

A review of the most significant models follows. For the purpose of this analysis, the term "model" is used to refer not only to computer programs that simulate resource production, effects, etc., but also to other computer tools (database systems, for example), which may not do much more than facilitate the management of large amounts of interrelated data. For ease of analysis, the models have been divided into four types: fire (and fuel), wildlife, hydrology, and recreation/scenic quality models. In

addition, a database of the most significant models has been constructed, using the format developed in a "catalogue" of computerized analytical tools recently published by the Intermountain Research Station (Schuster et al., 1993). Printouts of the database information (including publication citations, names and addresses of model developers, etc.) for the models discussed here are attached in Appendix A.

2. Fire and Fuel Models

2.0 Background: Rothermel Spread Model and Fuel Models

The National Forest System depends heavily on several key models for assessing fire danger, quantifying fuel conditions, predicting fire behavior, and analyzing fire effects. Many, if not most, of these models are products of the Intermountain Fire Sciences Laboratory in Missoula, Montana, where researchers have been modeling and analyzing the characteristics of forest fires for over 30 years.

The fundamental mathematical basis for the bulk of fire prediction and behavior assessment in the United States is "A Mathematical Model for Predicting Fire Spread in Wildland Fuels" (Rothermel, 1972). Generally referred to as the Rothermel model, this series of equations relates fire reaction intensity and spread rate to a range of fuel, weather, and topographic inputs (including fuel loading, depth, surface-to-volume ratio, heat and moisture content, wind velocity, and slope) and serves as the basis for the two most widely used computerized fire planning tools, the National Fire Danger Rating System (NFDRS) and the BEHAVE fire behavior prediction and fuel modeling system.

Vegetation information is incorporated into these models through the use of fuel models. These "models" are simply generalized collections of fuel properties, including

qualitative descriptions of the prominent vegetation or management feature -- grass, shrub, timber or slash -- and quantifications of fuel load and fuel bed depth. Especially significant in differentiating the fuel models is the fuel load by size class -- under 1/4" in diameter (1-Hour fuels), between 1/4" and 1" (10-Hour), and between 1" and 3" (100-Hour) -- for both live and dead fuels (Anderson, 1982).

There are 20 different fuel models (lettered A through U) used in NFDRS to describe the broad fuel characteristics in areas 10,000 acres or larger. A different set of fuel models (numbered 1 to 13) is used in site-specific project-level fire behavior estimation with BEHAVE. Anderson (1982) provides brief descriptions of the vegetative conditions that constitute each of these 13 stylized models as well as a chart correlating them with the NFDRS fuel models.

2.1 Rating Fire Danger

Assessing the danger of wildland fire initiation and spread is essential for managing fire suppression resources and determining the basis for restrictions and closures of recreation areas and industrial operations. Virtually every respondent to the fire model survey uses some kind of modeling in this area. In most of the United States, fire danger rating is done using three interrelated systems, the Weather Information Management System (WIMS), NFDRS, and FIREFAMILY.

In 1993, WIMS replaced the Administrative and Forest Fire Information Retrieval and Management System (AFFIRMS). WIMS provides its users (which include not only the Forest Service but also many other federal, state, and local land management agencies) with access to the most comprehensive wildland weather data available. Centrally located at the USDA's National Computer Center in Kansas City, WIMS

receives weather data via the National Weather Service (NWS), manual fire-weather stations, the Bureau of Land Management's Remote Automatic Weather Stations, and other sources. Satellite transmission, direct dial-up links, and the NWS-Telecommunications Gateway allow WIMS to make this data available to users in a near real-time environment. WIMS also provides access to the historic fire occurrence and fire weather data contained in the National Interagency Fire Management Integrated Database (NIFMID). Further, WIMS is the primary processing platform for NFDRS.

NFDRS generates indices of fire danger for large-scale planning areas (again, greater than 10,000 acres). Developed at the Intermountain Fire Sciences Laboratory, NFDRS is now maintained by Fire & Aviation Management in the Washington Office. NFDRS takes daily weather observations and forecasts, in combination with broad-scale vegetation and topographic information, and assesses the condition of wildland fuels, the risk of wildfire occurrences, and the characteristics of initiating wildland fires.

FIREFAMILY performs statistical analyses on the historical weather and fire occurrence data stored in NIFMID, allowing NFDRS users to fine-tune fire danger indices to local areas and establish the basis for setting "fire danger levels" from the daily indices. Both NFDRS and FIREFAMILY are widely used throughout the Forest Service and are available in personal computer (PC) versions as well as through WIMS.

2.2 Predicting Fire Behavior

After fire danger models, the next most regularly used tools of the survey respondents are fire behavior models. The purpose of behavior models is not to assess whether a fire will start but how it will burn once started. They can be

used in monitoring and/or suppressing wildfires and in planning prescribed fires.

Developed by the Intermountain Fire Sciences Laboratory, BEHAVE is the foremost behavior prediction system, used virtually nationwide. (It is international, as well, having been translated into Russian, Chinese, and Spanish). BEHAVE consists of five sub-programs: two for developing custom fuel models, two for predicting fire behavior, and one for assisting in prescribed fire planning. In the behavior prediction programs, the user inputs a fuel model (or enough data to customize a fuel model) and a specific set of weather conditions. In the planning program, the user can specify desired fire behavior (given the prevailing fuel model), and BEHAVE will determine an appropriate range of weather conditions in which the burn could be initiated.

Some of the calculations BEHAVE will perform include rate of spread, flame length, intensity, fine dead fuel moisture, area, perimeter, maximum spotting distance, crown scorch height, probability of tree mortality, and probability of ignition. While BEHAVE describes how quickly, broadly, and intensely a fire is likely to burn, it does not analyze the lasting effects of fire.

While NFDRS and BEHAVE are truly the U.S. fire danger and behavior models, for certain areas, notably Alaska, the Canadian Forest Fire Danger Rating System (CFFDRS) is a valid alternative. Consisting of a Fire Weather Index system and a Fire Behavior Prediction system, CFFDRS was developed by Forestry Canada to determine ease of ignition, rate of spread, difficulty of control, and impacts of wildfire in the fuel types specific to that country. The geographic limitations to widespread use of CFFDRS in the U.S. are obvious.

Also, the Pacific Northwest Region has developed a model called the Rare Event Risk Assessment Process (RERAP). As its name suggests, the model calculates risk associated with certain phenomena associated with fire movement, fire spread, and fire-ending weather. While not used as widely as some of the other fire models, this model seems to have generated increasing interest among fire managers. Links between RERAP and fire behavior programs such as BEHAVE are possible.

2.3 Pest Implications in Fire Danger and Behavior Prediction

As forest pests alter the amount, type, and condition of existing vegetation, several opportunities exist for relating their impacts in the selection and/or customization of fuel models. That these fuel models are crucial inputs in both fire danger and fire behavior prediction indicates the potential importance of developing such relationships.

One way this might be accomplished is by directly linking the volume of standing dead trees to the amount of fine dead fuels in each diameter size category. A more general, less direct connection might be made by relating other macro stand information (trees per acre, species composition, stand structure, etc.) and individual tree characteristics (crown ratio, height, DBH) to fuels distribution. These relationships would, of course, mean great potential for integrating dynamic vegetation simulation (in the form of PROGNOSIS, for example) with fuel model generation.

A pair of computer programs designed at the Intermountain Fire Sciences Laboratory, DEBMOD and DFINV, might provide the keys to establishing some of these connections between pests, stand structure, and fuels. DEBMOD predicts the weight of debris from timber inventory data, by species and DBH class. DFINV calculates the weight, volume, and depth

of dead and downed woody material, using the planar intercept method for collecting data. A publication out of the Pacific Northwest Region (Hilbruner and Wordell, 1992) provides a good overview of the elements of fuel appraisal, including debris prediction and the planar intercept method. More investigation into possible crosswalks between DEBMOD, particularly, and pest models may well be warranted; at present, however, neither DEBMOD nor DFINV seems to be used very widely within the National Forest System.

2.4 Describing Fire Effects

Several different kinds of models are used to predict the effects of fire. The outputs of these models range from numeric estimates of fuel consumption and smoke production (necessary for Environmental Impact Statements) to qualitative descriptions of the effects of fire on other resources, especially wildlife habitat. Judging from the responses to the DG survey, these models are not nearly as widely used as fire danger and behavior systems; however, this may be related more to the specific jobs of the survey respondents than to the relative importance of fire effects. Certainly the implications of fire modeling for forest pest management, discussed below, are quite significant in the area of fire effects models.

Probably the heaviest use of fire effects models is in the application of prescribed burns. CONSUME, a fuel consumption model designed by the Pacific Northwest Research Station, provides a good example. CONSUME calculates woody fuel and duff consumption as a function of general climatic conditions, daily weather data, fuel moisture, etc. Through the incorporation of an average emission factor, it can also be used to predict the amount of smoke produced, which helps the resource manager determine the appropriate time and place to conduct a prescribed burn, not only to achieve the

desired fuel reduction, but also to minimize impacts on air quality, soil, water, wildlife, recreation, and other resources.

Where prescribed burns may be initiated in part to control forest pests, the potential for implementing a fuel consumption model such as CONSUME would be great. For more specific smoke estimation, several additional models are available, including the Simple Approach Smoke Estimation Model (SASEM). (For a handy one-page matrix of general information about these and other models dealing with fuel consumption and smoke production, the reader is encouraged to contact Ann Acheson in the Northern Regional Office in Missoula).

Another significant fire effects model is the Intermountain Fire Science Laboratory's First Order Fire Effects Model, or FOFEM. In addition to predicting fuel consumption and smoke production, FOFEM generates estimates of tree mortality (in terms of probability of death for an individual tree and percent of dead trees in a stand) and soil heating. Since FOFEM assesses these effects for prescribed fires or for wildfires, the model has been used both in project planning and as an aid in evaluating larger-scale resource management activities.

FOFEM's prediction of individual tree and stand mortality represents a major leap in terms of the potential for linkages with both forest vegetation simulation and pest models. In fact, a collaborative effort between the Intermountain Fire Sciences Laboratory and the Forestry Sciences Laboratory in Moscow, Idaho is actively pursuing these links and plans to contract for implementation within the year. (The teams are, at the same time, hoping to tie the FVS into dynamic fuel appraisal models, as discussed above.) The successful connection between these models

would allow, in effect, a direct link between initial fire effects and a host of secondary effects including tree regeneration, hydrologic changes, and vegetative succession.

Finally, the Fire Effects Information System (FEIS) is an expert system used to query and review all available literature on the effects of fire on more than 500 plant species, 30 wildlife species, and 10 plant ecosystems. Located on the DG, FEIS is described as a "computerized knowledge processor [designed] to provide managers with easy access to the state-of-the-knowledge about effects of fire" (Schuster et al., 1993). A source of qualitative not quantitative knowledge, FEIS gives easy-to-understand descriptions of, for example, fire adaptations in plants and fire-related features of wildlife habitat.

Since FEIS is not really a "model" of fire effects, its significance for pest management would be limited to the possibility of incorporating the effects of fire on forest pest habitat into the FEIS database. Adding such information would at least give managers a general picture of how a proposed action might affect pest management efforts.

3. Wildlife Models

3.0 Background

In contrast with fire modeling, the use of models assessing wildlife habitat varies significantly from region to region and even from forest to forest, reflecting the models' considerable geographic and species-specificity. While this specificity can often limit the scope of many models to a particular species of interest in a particular locale, the similarity in their general structure and emphasis suggests

several opportunities for successfully integrating these models with vegetation simulation and pest models.

Five general categories of wildlife habitat models were identified most often by survey respondents. These are single-species Habitat Suitability Index (HSI) and Habitat Effectiveness Index (HEI) models, Habitat Capability (HABCAP) models, Wildlife Habitat Relationship (WHR) systems, cumulative effects models, and population models.

While each of these modeling approaches features certain unique elements (discussed below), the common threads in the overall process of habitat evaluation warrant brief consideration here. Different landscapes can provide habitat of varying significance for wildlife, depending on time of year, stage of the animal's life, limiting factors in the animal's diet, etc. Still, three crucial components of habitat seem to drive most of the modeling efforts -- reproductive habitat, forage supply, and safety cover. All of the habitat models discussed attempt to relate one or more of these three elements to the type, age, size, and structure of vegetation present on the landscape. How the models derive the relationships, of course, is what sets them apart and what will, ultimately, determine their potential for integration with other models.

3.1 Habitat Suitability and Effectiveness Indices

HSI and HEI models are oriented toward the assessment and management of habitat for a single species of special interest. The U.S. Fish & Wildlife Service (USFWS) developed the HSI series of models beginning in 1981 in order to emphasize the "quantitative relationships between key environmental variables and habitat suitability" (Schamberger et al., 1982, p.1). Forest Service wildlife biologists from Vermont to Washington use HSIs for species

of management concern, including wild turkey, gray squirrel, brook trout, black bear, pine marten, barred owl, and many others.

The HSI model for the eastern wild turkey illustrates the general inputs and outputs of any HSI. Turkey habitat is first described qualitatively according to each of several uses or "life requisites" -- general, food, water, cover, etc. -- based on expert knowledge of what the animal needs. Statements such as the following are typical of this descriptive section of an HSI: "Healy (1978) estimated that the best habitat for young broods in the Southeast consisted of a complete cover of forbs and grasses, 40.0 to 70.0 cm tall, with a biomass of 600 to 3,000 kg/ha dry weight" (Schroeder, 1985, p.6).

Following the descriptive text, each model defines its applicability in terms of geographic area, season, cover types, minimum habitat area, and level of verification. Cover types are delineated using USFWS terminology; for example, DFW = Deciduous Forested Wetland, ESS = Evergreen Shrub Savanna. The model then computes a suitability index, from 0.0 (unsuitable) to 1.0 (optimal), according to the categories of habitat use defined for the species. It is noted that with this scale comes an assumption of "a positive relationship between the index and habitat carrying capacity" (Schamberger et al., 1982, p.1).

For the eastern wild turkey, indices are computed for summer food/brood habitat suitability, fall/winter/spring food suitability, and cover suitability. Incorporated in each index is a compositional component assessing the relative area needed to provide optimal habitat for that specific life requisite. The overall HSI is then defined as the lowest of these three life requisite values.

Similar to HSIs in that they combine separate indices for cover and forage quality, Habitat Effectiveness Indices (HEIs) incorporate two additional sub-indices -- one based on the size and spacing of cover and forage areas, the other on road density. The overall HEI is then computed as the geometric mean of these four components. Computer programs available to generate HEI indices (all for elk, interestingly) include HEICALC, HEIWEST, and HEI2; three other programs (HIDE2, HIDE2X, and ELK COVER) are designed to calculate hiding cover only.

In detailing the characteristics of landscapes which contribute to suitable habitat for a species, the HSI and HEI models are at least as thorough as any other models receiving comparable use. However, for the purposes of pest management, the single-species focus of these models poses an obvious challenge to linking them with vegetation simulation models, due to the considerable amount of programming that would be required. On top of this obstacle, the HSI models add another, namely the use of different forest cover type classifications than those used in the Forest Service. For these reasons, it is likely that the short-term potential for integration of pest and wildlife models will be greatest with models, such as Habitat Capability models, of Forest Service development.

3.2 Habitat Capability (HABCAP) Models

Habitat capability is defined as "the ability of a given unit of land to support species of wildlife based upon specific vegetation characteristics" (USDA Forest Service, 1994b, p.1). HABCAP models, used in Regions 2, 3, 8, and 10, differ from HSIs in several key respects: (1) they evaluate habitat for more than one species at a time; (2) they explicitly link index values to potential population numbers; (3) they tend to be less detailed than HSIs in

defining species' life requisites and the characteristics that contribute to habitat. The differences between the four regions' HABCAP models are minor, mostly having to do with the particular species evaluated and the sources of the vegetation information input.

Region 2's HABCAP model, R2HABCAP, estimates habitat capability for roughly 50 species of birds and mammals. Each species' habitat capability index (HCI) is computed as the geometric mean of forage and cover value indices, which are determined by forest cover type and structural stage with the help of a book (Hoover and Wills, 1984) and a set of matrices (USDA Forest Service, 1981). Forest data is supplied by the resource inventory database (Stage II inventory). The number of animals that an area can potentially support (essentially, carrying capacity) is then defined as the product of each species' HCI, its maximum population density under optimal conditions, and the number of acres.

R2HABCAP runs both on the DG and in a spreadsheet version for PCs. At present, work is underway to develop a version of R2HABCAP that is tied to a geographic information system (GIS). When the GIS version is completed, linking the system to the Forest Structure Simulator Model (FSSIM) is planned. This potential linkage represents one more significant difference (and advantage) of the HABCAP model over the HSIs, which, as mentioned earlier, are tied to USFWS cover type descriptions.

Region 3's HABCAP model is called WESTWILD. While it features some interesting add-on calculations (such as net value of Wildlife and Fish User Days, and alpha and beta biodiversity indices), it presently receives limited use, according to the regional wildlife biologist. A database of cover type and six vegetation structural stages is used to

derive the habitat capability indices and potential population numbers for 23 bird and mammal species.

Region 8's HABCAP model, called HABSIM, is used as a project-level analysis tool to calculate coefficients for Management Indicator Species, mostly game species. The vegetative data (forest type and age class) for these models come from the Continuous Inventory of Stand Conditions (CISC) database, and the model resides within the region's COMPATS management shell. The coefficients generated represent either habitat indices or potential numbers of animals. The Daniel Boone NF and the Chattahoochee NF have modified the model to be forest-specific with respect to their indicator species and forest types.

In Region 10, HABCAP models have been developed for each of 13 Management Indicator Species (birds and mammals) on the Tongass National Forest in Southeast Alaska. These models access habitat and landscape attributes through timber management inventory in a GIS (Arc/Info) database, allowing for spatial representation of habitat distribution. This link is an important advantage of the Southeast Alaska model over the other three regions' HABCAPs; unfortunately, it has not been fully exploited because (1) the modeling remains essentially static, not dynamic, and (2) like Region 3's WESTWILD, the model has been used mostly in Forest Plan revisions, not in implementation and monitoring.

The plans to link R2HABCAP to FSSIM are indicative of the management significance of model integration. That HABCAPs generally use standard vegetation information -- forest cover type and stand age or structural stage -- suggests that such integration can be achieved relatively easily. From the wildlife modeling perspective, however, linking HABCAPs to a GIS has higher priority, since the ability to assess the spatial arrangement of habitat is crucial to

understanding such phenomena as fragmentation, corridors, and metapopulations. Wildlife habitat models that already consider spatial distribution are considered next.

3.3 Wildlife Habitat Relationship (WHR) Systems

In WHR systems, databases of expert information are used in conjunction with computer programs to assess habitat for a large number of species at once. The databases represent the link between vegetation information -- cover type and structural stage -- and habitat indices for each species, while the computer programs allow the user to specify the scope of the desired analysis. Maps showing the location of optimal habitat are made possible through GIS. WHR systems of significance have been developed for Regions 5, 6, and 8.

The California WHR system assesses habitat for over 600 terrestrial vertebrate species -- essentially the full range of vertebrates occurring in California. Developed by Irene Timossi and Reg Barrett at the University of California, Berkeley for the state's Department of Fish & Game, the WHR system is used throughout the state. Like the HSIs of the USFWS, the WHR database can incorporate substantial detail on vegetative components of wildlife habitat, including many hard-to-model features of the landscape (e.g. snags, caves, and carrion). Output is similar to that of an HSI: a 0.0 to 1.0 scale indicates an area's suitability for each of three life requirements -- forage, cover, and breeding habitat. The user can condense the three ratings into a single suitability index using arithmetic or geometric means and can then map areas of suitable habitat using GIS in conjunction with the WHR system.

Several modeling programs can be run along with the WHR modules, including GROWILD, a tool for assessing the cumulative effects of management activities on wildlife

habitat. The user specifies current inventory conditions, an expected path of succession, a simulation period, and a timber harvesting regime, and GROWILD computes changes in the number of acres of optimal and suitable habitat for the wildlife species of interest. A key limitation of the WHR system and these affiliated programs is that they apply only to California.

In Region 6, the Mt. Hood National Forest has recently developed a WHR model called HABSCAPES, which consists of a set of relational databases containing WHR information, a vegetation database, and computer programs that use a landscape-scale approach in defining appropriate habitat. Wildlife habitat relationships have been constructed for 307 species of terrestrial vertebrates grouped together in "life-history guilds" that share similar home range sizes and prefer certain seral stages and patch configurations as habitat.

The computer programs in HABSCAPES perform spatial analysis on the vegetation database, ensuring that the appropriate landscape patterns are considered in designating habitat. This explicit consideration of habitat arrangement -- connectivity, mosaics, contrast, etc. -- represents significant progress in habitat modeling. Several other forests in the region have taken preliminary steps toward incorporating HABSCAPES in their analyses, and it is expected that the model will be adapted rapidly for use throughout the region.

A new, spatial version of Region 8's BIRDHAB model has been beta-tested in selected sites and is expected to be ready for regionwide use beginning this summer. The model's habitat relationship database encapsulates expert analysis on wintering and breeding habitat for 259 bird species contained in a voluminous Nature Conservancy publication

(Hamel, 1992). Habitat is classified qualitatively as optimal, suitable, marginal, or unsuitable and then displayed within an analysis area using Arc/Info.

Like the HABSIM model, BIRDHAB gets its vegetation information from the region's integrated CISC database. Since the classification systems of CISC and Hamel did not coincide, crosswalk tables were constructed to resolve ambiguities. Development of similar tables to equate various vegetation databases both within the Forest Service and with those of other federal and state agencies will be essential if a fully-integrated national wildlife habitat relationship system is ever to be implemented.

3.4 Cumulative Effects Models

Cumulative effects models assess the impacts of multiple human actions, separated in time or in space, on natural resources. For certain wildlife species, especially those with large home ranges and/or strict requirements for connected habitat, consideration of such effects is essential. Two such species are the grizzly bear and the northern spotted owl.

Incremental Cumulative Effects (ICE6) is a collection of computer programs for assessing cumulative effects on grizzly bears in the Greater Yellowstone and Northern Continental Divide Ecosystems (parts of Wyoming, Montana, Idaho, and Eastern Washington). Developed by Systems for Environmental Management in Missoula, ICE6 outputs three measures of grizzly bear habitat: underlying habitat value, the habitat effectiveness as impacted by roads, trails, development, etc., and a mortality risk index resulting from these same activities.

The inputs required to run ICE6 are extensive and include definitions of spatial boundaries, seasons, vegetation types, habitat coefficients, activity types and impacts, and mortality coefficients. These inputs are set up in ORACLE data tables, and results can be displayed in tables, graphs, or maps (by converting them to Arc/Info or GRASS format).

For assessing cumulative effects on the northern spotted owl, a program called, fittingly, OWL was developed at the Redwood Sciences Laboratory in Arcata, California. The model simulates the dispersal of individual owls through hexagonal cells of varying habitat quality over a 100-year period. The specific attention to organisms (instead of just habitat) further sets the OWL model apart; the inclusion of relationships linking habitat quality to owl survival and fecundity allows potential impacts to be expressed in terms of owl population. The model has been used to evaluate owl habitat in Oregon and on the Olympic Peninsula in Washington.

As cumulative effects models are applied only to certain highly sensitive organisms, their potential for integration with vegetation simulation and pest models is probably not great. Especially given the degree to which these models are tailored to particular users with very specific knowledge (for example, the grizzly bear mortality risk associated with the construction of a logging road), it is recommended that other avenues for integration with more general habitat models be explored first.

3.5 Population Models

For many wildlife ecologists, habitat models present only half the picture. Population dynamics models attempt to paint the other half by modeling the changes in wildlife populations that may be independent of habitat alterations.

A small business in Setauket, NY, called Applied Biomathematics has developed RAMAS, a family of models that track such phenomena as metapopulations and habitat fragmentation. One version of RAMAS incorporates a GIS-based landscape component and seems to be of particular interest to agency biologists. The implications of population models in general for forest pest management are unclear, however, and will require further study.

As with fire and vegetation model integration, active exploration of the possibility of links between wildlife habitat models and vegetation simulations is already underway. A forest vegetation simulation and wildlife habitat modeling integration workshop held in September 1993 at the Priest River Experimental Forest in Northern Idaho brought together 20 Forest Service researchers and modelers from the Washington Office, Regional Offices, Research Stations, and individual Forests. The workshop provided an opportunity for the wildlife biologists to learn more about the Forest Vegetation Simulator (FVS) and to express their opinions about the opportunities and priorities for short- and long-term integration between the FVS model and their primary habitat analysis tools.

Some of these suggestions are presented here. They include integrating snag dynamics models (such as the Snag Recruitment Simulator and Snag Dynamics Projection Model) and data on dead and downed material into vegetation models, developing a standardized database format for vegetation data, and linking the FVS to GIS output. The progress made on these issues in the 18 months since the Priest River meeting may give a good indication of at least the short-term potential for further integration.

4. Hydrology Models

4.0 Background

Hydrology models, as they relate to the management of vegetation, typically take one of three forms: water yield models, sediment models, or fish habitat models. Water yield models predict the increase in water runoff from slopes as a result of the removal of vegetation, whether by timber harvesting, grazing, or fire. Sediment models consider natural rates of sedimentation according to base geologic properties and then simulate the added sediment produced by disturbances such as road construction, logging, and fire. Several programs combine water and sedimentation yield predictions into one working shell.

Estimates of water yield and sediment production are of crucial importance to fish habitat models. In addition, the presence and condition of streamside vegetation directly influences fish habitat by affecting stream temperature (through shading) and contributing falling pieces of large woody debris. Simulation models that address these two important components provide unique opportunities for incorporating vegetation simulation modeling in fisheries analysis.

Watersheds seem to be increasingly cited as preferred scales of delineation for many areas of forest management. Thus, one expects that the use of existing hydrology models, as well as the development of new ones, will see an increase as well.

4.1 Water Yield Models

The chief water yield model cited by survey respondents is WRNSHYD, the hydrologic portion of a joint effort of the

Forest Service and the Environmental Protection Agency to evaluate the effects of non-point pollution on water resources. (The name of the larger model is WRENSS: Water Resources Evaluation of Non-Point Silviculture Sources.)

WRNSHYD estimates the effects of existing or proposed silvicultural activities (including harvest) on annual water yield. The computer version of WRNSHYD was developed by a Canadian firm, R.H. Swanson & Associates, and applies to the continental U.S. and Canada. Several local versions have been adapted, including HYSED, a water and sediment yield model developed for Region 2; WATSED, a similar model for Region 1; and WWPEAK, a peak flow model developed for the Wallowa-Whitman NF in Eastern Oregon.

The principal driving vegetation variables for water yield models include basal area and height, or, alternatively, leaf area index. These variables are normally used to predict the effects of the removal of vegetation (through timber harvest or grazing) rather than the growth of vegetation. Still, the fact that basal area is a direct output of PROGNOSIS suggests an easy link between these two models. The effects of pests on basal area could then be directly incorporated into these water yield models.

4.2 Sediment Models

The "grand-daddy" of the bulk of the sediment models in use (at least in the Western U.S.) is "A Guide for Predicting Sediment Yields from Forested Watersheds" (Cline et al., 1981), written for Regions 1 and 4 in 1981 by a team of soil scientists, hydrologists, and watershed specialists from the two regions. This model, referred to as the R1/R4 Sediment Model, was developed for forested watersheds in or associated with the Idaho Batholith. While never computerized itself, the R1/R4 Sediment Model has spawned

many computerized site-specific offspring including BOISED for the Boise and Payette NFs, WATSED for Region 1, SALSED for the Salmon, NEZSED for the Nez Perce, WWSED for the Wallowa-Whitman, and versions for the Challis and Caribou NFs.

The approach in each of these models is basically the same. Natural sediment yield is predicted based on "landtypes" (incorporating landform, geologic, soil, and general vegetative characteristics) and hazard rating for mass erosion. (WWSED restricts this analysis to the eroded material produced within "filter strips" next to stream channels.) Added to this base sediment value are management-induced components of surface erosion and mass erosion -- the results of roads, logging, or fire (prescribed or wild). Delivery of eroded materials to stream systems is simulated, and this sediment is then routed through the watershed.

To use any of these sediment models, the user must be able to provide a fair amount of information about the "landtypes" in the watershed in question. Slope gradient and configuration, bedrock, soil texture and depth, precipitation, potential vegetative cover types, and presence of buffers are among the landscape characteristics that help determine the natural sediment yields and geologic erosion factors which, in turn, determine sediment yield vis-a-vis management activities.

The models' outputs are expressed in tons of sediment per square mile per year; these values are intended to contrast different management activities, not to predict absolute amounts of sediment. Since sediment results primarily from ground disturbances like road construction, there is less potential for integration with vegetation routines in sediment modeling than in water yield modeling. Similarly,

the effects of fire and logging are determined according to their impacts on soil rather than on vegetation, so variables such as fire intensity and the method of removing logged trees become significant inputs.

A model developed for agricultural areas, Water Erosion Prediction Project (WEPP) has some significant applications in forest management. It is the result of collaboration between the National Soil Erosion Lab at Purdue University and researchers at the Intermountain Station. While WEPP has been applied within the Forest Service mostly to predict sediment from roads, its other features include a single-storm simulation model, a model of snow drifting and melting, and the planned incorporation of forest regeneration routines. As this model becomes more widely used, it may warrant greater attention as a candidate for linking to the Forest Vegetation Simulator.

The models that combine water yield and sediment yield calculations include WATSED, HYSED, and SEDROUTE, developed by Dennis Kelly on the Manti-La Sal NF. Other traditional hydrology models of note are an as-yet-undocumented sediment delivery model by Walt Megahan and Gary Ketcheson used on the Boise and Payette Forests, and two cumulative effects models -- WATBAL, used in Regions 1 and 4, and IMPACTS, used in Region 8.

4.3 Fish Habitat Models

BOISED, WATBAL, IMPACTS, and other water and sediment yield models are either directly linked to fish habitat models or can be used in fisheries analysis. Increased sediment is generally detrimental to coldwater fish, while the effects of water yield increases can be positive or negative, depending on their extent. Developing ties from forest vegetation and pest models to these water and sediment yield

models will, therefore, also relate vegetation and pests directly to fish production.

In addition, two models more explicitly relate vegetation to habitat conditions for fish. SHADOW, a stream temperature model developed by Chris Park of the Siskiyou NF, estimates the percent of a given stream that is unshaded and uses this information to calculate maximum stream temperature. Not quite two years old, SHADOW seems to be catching on quickly with fisheries biologists, at least in the Intermountain and Pacific Northwest Regions.

SHADOW's emphasis on streamside vegetation provides enormous potential for integrating it with the vegetation and pest models. The key vegetative inputs of the SHADOW model include tree height, shade density, percent tree overhang, and distance from stream channel to base of vegetation. While some of these inputs can be more easily obtained from vegetation models than others, any or all of them could be seriously impacted by pest infestation.

Finally, John Van Sickle and Stan Gregory at Oregon State University have developed a probabilistic model for determining another important element of fish habitat, namely, the total number and volume of large woody debris pieces falling into a stream reach over a given time period. Like SHADOW, this WOODY DEBRIS MODEL requires as input several streamside vegetation characteristics (specifically, riparian stand density, height distribution, and zone geometry; tree-fall probability distributions; and rates of regeneration). While this model generated only passing interest among respondents to the DG survey, it has great potential for integration with vegetation simulation routines. Developing links between the FVS and snag dynamics models, as discussed with regard to wildlife habitat modeling, would make such integration easier.

5. Recreation and Scenic Quality Models

5.0 Background

Of the four broad categories of non-timber resource models addressed in this review, those guiding the management of recreation and scenic quality are perhaps the toughest to summarize. The human dimensions of this resource and the inherent obstacles to quantifying recreation experiences or scenic beauty contribute to this difficulty, as do the many changes taking place in this area -- development of two major new national systems, for example. Also, the nature of the "models" -- in some cases, more information banks and sets of management principles -- is very different from those in the other three categories.

At the same time, recreation and scenic quality are as affected by vegetation and pest management as any other resource, if not more so. The damage, defoliation, and mortality inflicted by a handful of forest insects and pathogens (spruce budworm, dwarf mistletoe, mountain pine beetle, blister rust, etc.) can reduce the recreational appeal of a forest almost as much as a clearcut. Thus the integration of forest vegetation simulation and pest models with recreation and scenic quality models must be considered a high priority task.

5.1 Recreation Models

Most of the computerized tools used to manage recreation in the National Forest System are information systems. The Recreation Opportunity Spectrum (ROS) and the Recreation Resource Information System (RRIS) are two such widely-used systems. In 1994, an agency-wide application called "Infrastructure" was designed to encompass ROS and RRIS (as

well as a few lesser-known recreation data sources), prevent redundancies in data collection and storage, and provide links with forest and range vegetation information and with the GIS capabilities of the anticipated Project 615 computer system.

While it is clear that the immediate future of recreation management modeling lies in Infrastructure, what is unclear is how the connections to vegetation will be initiated or maintained. This caveat having been stated, what follows is a rundown of ROS and RRIS, the major components of recreation management that comprise Infrastructure.

As its name suggests, ROS is concerned with the range of opportunities provided to recreationists. It serves as a planning tool by guiding managers in the establishment of broad zones of recreation opportunities. The "spectrum" consists of six categories of settings, matched to appropriate activities, facilities, and experiences. From primitive to roaded natural to urban, each type of setting is characterized by access, remoteness, social encounters, visitor management, facilities and site management, visitor impacts, and naturalness. The delineation of opportunity classes is based on the idea that a normal level of access (or visitor impacts, naturalness, etc.) in an urban setting would be incompatible and unacceptable in a primitive area, and vice versa.

Because setting in outdoor recreation depends heavily on the presence of thriving plant life, the nature of the existing vegetation is an important component of setting in ROS. The naturally-occurring landscape features (vegetation, landforms, and waterforms) comprise what ROS terms the character of the setting; the manifestation of those features as a result of human alterations, especially management, is the setting condition. In an urban or rural

setting, condition may be maintained through planting of exotic species or by considerable pruning, manicuring, etc.; in primitive, semi-primitive, and roaded natural settings, emphasis is on a natural or "natural-appearing" environment.

RRIS, which evolved from RIM (Recreation Information Management), is a national inventory of recreation facilities (including trails), recreation use, and funding needs. The inventory side of RRIS includes descriptions of what, where, how big, and how good a recreation setting or facility is. The use side includes counts of visits, "activity occasions," Recreation Visitor Days (RVDs), as well as demographic information, forecasts of future participation, and economic trends.

As previously stated, it remains to be seen how Infrastructure will incorporate vegetative information. The screens for entering vegetation condition of rangeland management units have been completed; those for forested land are still being developed. The rangeland screens identify areas as meeting or moving toward desired condition, and also track locations of various treatments (prescribed burns, applications of herbicide or fertilizer, seeding, etc.) and the improvement objective (forage improvement, cover manipulation, etc.) of each treatment. While Infrastructure clearly promises to be a very important recreation management tool, until its ties to forest vegetation and spatial data are firmly established, there may be limited potential for linking it to the FVS and/or pest models.

5.2 Scenic Quality Models

The scenario just described for Infrastructure also applies to the Scenery Management System (SMS), the Forest Service's new integrated model to manage scenic resources. The

initial publication for the SMS has undergone several revisions in the past six months and has not been received as of this writing. However, pilot programs are operational on the Kisatchie NF in Louisiana and the Jefferson NF in Virginia, and successful training sessions have been held in other regions. The Kisatchie has produced a written overview of the SMS process which shows what the nationwide SMS will likely entail.

In Step 1 of the Kisatchie SMS, the forest is classified into ecological units, based on both the National Hierarchical Framework of Ecological Units and the Ecological Classification System derived from Bailey's Ecoregions (USDA Forest Service, 1994a). Landscape units or Land Type Associations range from 25,000 to 500,000 acres in size, with fairly uniform land-surface form, vegetative cover, rock forms, geology, and water forms.

In Step 2, Scenic Attractiveness is mapped for 30-meter square parcels of land, using a numerical point scale for visual quality of landform based on slope; rock outcroppings; vegetative cover (forest types); proximity to lakes, Wild & Scenic Rivers, or streams; and special areas (wilderness, bogs, etc.). A Class A Distinctive rating is assigned to parcels with 25+ points; Classes B+, B, and C follow accordingly.

Step 3 involves evaluating Existing Scenic Condition in a GIS based on size of contiguous stands, and Step 4 maps landscape visibility (foreground, middleground, and background) from viewsheds as well as distances from travelways and use areas. Scenic Attractiveness and these distance zones then are combined into a map of scenic classes.

Some criticism of SMS has targeted its determination of scenic attractiveness by "experts" (landscape architects, primarily) rather than through direct public opinion. In the evaluation of management alternatives, computer visualization models (described below) could be used to display results at public meetings. Also, academic research in the field of scenic beauty estimation (SBE) models has had some success building regression equations relating popular opinion of scenic beauty to various quantifiable stand characteristics (stand density, average stand diameter, volume of downed woody debris, etc.). These SBE models have largely remained in the province of academia, however, and have not been used much in forest management.

Computer visualization models represent the application of cutting edge technology -- often a hybrid between GIS and visual simulation tools -- to managing scenic quality. The landscape architects responding to the DG survey identified several software programs including NewPerspectives (NEWPER) and VISQUAL, visual simulation models used to illustrate impacted areas; LANDCADD, a terrain-modeling program that allows incorporation of buildings, trees, landforms, etc.; and VISUAL F/X, which can link timber stand and digital elevation model (DEM) data. A national task force headed by Lyle Gomm of the Intermountain Region has been charged with reviewing state-of-the-art simulation activities applicable to natural resource management and recommending directions for future Forest Service application; the task force met in February and will publish its findings sometime this summer.

6. Summary

The major non-timber resource areas use a variety of quantitative and qualitative models to describe current conditions and to evaluate the effects of different management alternatives. The printouts of the database

descriptions of the most significant models discussed in this review are found in Appendix A. Each description contains the best available information about the model's geographic area of application, input variables, output variables, hardware and software specifications, type of analysis, and longer descriptions of the model's intended uses and users, limitations, outstanding features, etc.

Appendix B provides, in tabular format, comparisons across several of these variables between models addressing a particular resource or function. These tables are designed to give vegetation and pest modelers a handy reference to the specific integration opportunities of these non-timber resource models.

Integration of vegetation and pest models with non-timber resource management models is feasible, and would be useful. By linking resource models to vegetation simulation routines, the mostly static pictures of resource conditions they provide can become dynamic, and the tools can become more predictive. At the same time, the interactions between pest impacts and these resources are currently not being modeled. Linking the two kinds of models could provide a framework for these interactions to be better understood and managed.

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USDA Forest Service. 1994a. Ecoregions and subregions of the United States. Compiled and edited by Bailey, R.G., Avers, P.E., King, T., and McNab, W.H.

USDA Forest Service. 1994b. Habitat capability model for the Rocky Mountain Region: Documentation and user's guide. 42 p. USDA Forest Service, Rocky Mountain Region, Lakewood, Colorado.

1. Acronym and name: BEHAVE , Fire Behavior Prediction and Fuel Modeling System

2. Brief Description: Assists in predicting fire behavior and planning prescribed fires. Consists of 5 programs: NEWMDL and TSTMDL allow the development of custom fuel models; FIRE1 and FIRE2 predict fire behavior; and RXWINDOW aids in prescribed fire planning.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
P Ecosystem	S Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	Wildlife
P Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS or Data General AOS/VS

Software package(s):

9. Hardware requirements.

Computer: IBM or compatible microcomputer or Data General

Graphics Card:

Math co-processor: Recommended

Printer:

Disk Space:1 MB

RAM Space: 640 KB

Mouse:

Plotter:

Other: The programs are written in standard FORTRAN with no special requirements. The Data General and pc versions of the program are exactly the same.

10. Documentation/user support available.

On-line help	User's Manual
X Publications	X Updates
X Training	X Telephone Support

11. Principal developer.

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Other:

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ext.:

FAX: ()-

E-mail Address: M. Barrowcliff:W01C

Data General RIS file: W01C:FAM:BEHAVE:DUMP:BEHAVE_4.20.DMP
(DG version) W01C:FAM:PC:BEHAVE.EXE (pc version)

Acquisition Charge? ☒ No ☐ Yes:

14. Additional description of tool.

The BEHAVE system does not use a database, but rather depends on a knowledgeable user for valid input. The input is tailored to the application. For example, for prediction of an ongoing fire, a measured windspeed or wind from a spot weather forecast might be used. For planning purposes, a range of windspeeds might be used to answer a "What if?" question. Some of the calculations that can be done include rate of spread, intensity, flame length, area, perimeter, spotting distance, scorch height, tree mortality, and fine dead fuel moisture.

The wide use BEHAVE enjoys within the NF System means its importance in terms of pest integration is enormous. BEHAVE's vegetative information is obtained either through one of the 13 Fire Behavior Officer (FBO) fuel models (outlined by Anderson, 1982) or in the TESTMDL and NEWMDL routines within BEHAVE, which allow the user to customize a fuel model. The key vegetative inputs, in either case, are quantitative descriptions of the fuel loading (in tons/acre) and the fuel depth (in feet) distributed by diameter class (< 1/4", 1/4 - 1", 1 - 3"). These classes correspond to 1-hour, 10-hour, and 100-hour fuels, respectively. Live and dead fuels are counted separately, so while the character of a stand (species composition, age, density) will be important inputs, the stand's condition (as affected by forest insects and pathogens that kill and/or defoliate) may be the crucial factor in determining fuel loading. Elizabeth Reinhardt at the Missoula Fire Sciences Lab is the person to contact for more information re: the linking of pest models and the FVS with BEHAVE.

1. Acronym and name: CFFDRS , Canadian Forest Fire Danger Rating System

2. Brief Description: An integrated system that combines a fire weather information system and a fire behavior prediction system to assess the fixed and variable factors determining ease of ignition, rate of spread, difficulty of control, and fire impacts.

3. Geographical level of analysis (P = primary and S = secondary)

P Forestwide

S Subforest

S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

Cumulative Effects

Logging systems

Spatial

Economic/Financial

Monitoring

Transportation

Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

Wildlife

P Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

S Other: Weather

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS

Software package(s):

9. Hardware requirements.

Computer: IBM-compatible PC, laptop, palmtop, etc.

Graphics Card:

Math co-processor: No

Printer:

Other:

Disk Space:0.5 MB

RAM Space: 640 KB

Mouse:

Plotter:

10. Documentation/user support available.

On-line help

X

User's Manual

X

Publications

X

Updates

Training

X

Telephone Support

11. Principal developer.

Van Wagner, Stocks, Lawson, Alexander, Lynham, and McAlpine/ Forestry
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Data General RIS file:

Acquisition Charge? No X Yes:

14. Additional description of tool.

The two sub-components of CFFDRS are the Fire Weather Index (FWI) System and the Fire Behavior Prediction (FBP) System. The FWI System consists of six components (fine fuel moisture code, duff moisture code, drought code, initial spread index, buildup index, and the fire weather index itself) that, together, account for the effects of fuel moisture and wind on fire behavior. The FWI System requires daily measurements of dry-bulb temperature, relative humidity, wind speed, and precipitation. The FBP System outputs rate of spread (in m/min), fuel consumption (kb/m²), fire intensity (kW/m), and crown fraction burned. (Secondary outputs include head, flank, and back spread distances; flank and back spread rates and intensities; fire area and perimeter; rate of perimeter growth; length-to-breadth ratio.) Inputs to the FBP System are qualitative fuel descriptions (from one of 16 fuel 'models'), weather information (from the FWI Codes), topography, foliar moisture content (computed from date, latitude, longitude, and elevation), and the specific parameters of the fire (elapsed time, point or line ignition). A good overview of the CFFDRS and its components is provided by Stocks, et al., 12/89, Forestry Chronicle, 65:258-265. The equations of the FWI System and the FBP System are in the public domain; the acquisition information given is for FBP 93, a commercially-available stand-alone program that allows users in the U.S. to generate the FWI Codes from weather input and then proceed to the FBP System calculations.

CFFDRS is limited in its geographic applicability to Alaska, and parts of the Northern Rocky Mountain and Great Lakes States. Fuels inputs in the FBP System follow the Canadian classification system (16 models, of which 7 are coniferous, 4 mixedwood, 3 slash, and 1 each open and deciduous), which is qualitative rather than quantitative. This loose categorization of fuels (basically by cover type) places great limits on the potential for integration with veg. simulation or pest models--the specific data these models would output simply can't be accommodated in CFFDRS.

1. Acronym and name: CONSUME ,

2. Brief Description: CONSUME is a software product that provides fuel consumption estimates on prescribed slash burns, based on weather inputs and unit information.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide

S Subforest

P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

S Resource scheduling

Cumulative Effects

Logging systems

Spatial

Economic/Financial

S

Monitoring

Transportation

P

Ecosystem

S

Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

S

Air

Insect/Disease

S

Soils

Water

Cultural

Minerals

Timber

Wildlife

P

Fire

Range

S

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X

Computer program

7. Modeling techniques (P = primary and S = secondary)

P

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

S

Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS 3.0 or later

Software package(s):

9. Hardware requirements.

Computer: IBM or compatible microcomputer

Graphics Card: MONO

Math co-processor: Optional

Printer: Optional

Other: Display adaptor MDA

Disk Space:1.44MB

RAM Space: 512KB

Mouse:

Plotter:

10. Documentation/user support available.

X

On-line help

X

User's Manual

Publications

X

Updates

X

Training

X

Telephone Support

11. Principal developer.

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Title:

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FAX: (206)-553-7709

Phone: ()-

ext.:

FAX: ()-

E-mail Address:

Data General RIS file:

Acquisition Charge?

X No

Yes:

14. Additional description of tool.

The expected user is the district prescribed-burning personnel. Some inputs are daily weather variables such as maximum/minimum relative humidity and temperature, and unit variables from prescribed burn plans. Outputs are reports summarizing fuel consumption by date and fuel moisture. The program is best suited for Region-6-type ecosystems.

If fire is prescribed to curb an outbreak of infestation, CONSUME would be as helpful to a forest pest manager as to any other user--allowing him/her to plan the burn in order to avoid serious impacts to air and water quality. Inputs regarding the specific area to be burned include number of acres; fuel loading in tons/acre by diameter class; moisture content of 10-hour (1/4" to 1") fuels, expressed as % of oven-dry weight; targeted adjusted 1000-hour fuel moisture; duff depth in inches; slope; date of snow melt-off; and last timber harvest date.

The potential for integrating CONSUME with the FVS and pest models is limited, due to the site-specific, project orientation of this model. The data collection necessary to run CONSUME is probably not heavy enough to justify the programming time it would take to integrate the models; the data that are needed are also perhaps too tied to current weather conditions to be successfully modelled with the FVS. Better opportunities for fire effects integration with veg and pest models can be found with such models as FOFEM and FIRESUM.

1. Acronym and name: DEBMOD , Debris Prediction System

2. Brief Description: DEBMOD predicts the weight of potential debris from harvesting and thinning.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
P Ecosystem	Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	Wildlife
P Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS and Data General AOS/VS
Software package(s): Uses timber inventory or sale
cruise data, written in ASCII FORTRAN.

9. Hardware requirements.

Computer: IBM or compatible microcomputer or Data General	
Graphics Card:	Disk Space:
	RAM Space:
Math co-processor:	Mouse:
Printer:	Plotter:

Other:

10. Documentation/user support available.

On-line help	User's Manual
X Publications	Updates
Training	Telephone Support

11. Principal developer.

USDA Forest Service/Intermountain Research Station/Fire Effects: Prescribed
Fire and Wildfire

Other:

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Data General RIS file:
Acquisition Charge? X No Yes:

14. Additional description of tool.

DEBMOD's primary use is in predicting debris from timber harvesting. There are at least two versions of DEBMOD: the one developed at the Intermountain Fire Sciences Lab, and DEBMOD6, which is maintained by the Pacific Northwest Region. Mike Hilbruner in the Regional Office in Portland is the primary contact for DEBMOD6. A good introduction to both models, and to planar intercept fuel inventory methods and general fuel appraisal techniques, is "User's Guide to Fuel Appraisal", by Hilbruner and Wordell, Pacific Northwest Region, August 1992.

Debris prediction is done on a tree-by-tree basis. Data can come from a stand exam, timber cruise, or debris prediction exam, but must include general stand information (such as acres, slope, aspect, elevation, etc.) and individual tree data (including species, DBH, growth, age, and "tree class", which determines the % of foliage, branches, tips, bole, and bark available for debris based on qualitative descriptions of live and dead trees). Height, crown ratio, crown class, and form class are optional data. Output gives debris potential in oven-dry tons/acre, segregated by species and DBH class, distributed among fuel diameter classes (i.e. < 1/4"; 1/4 - 1"; 1 - 3"; > 3").

The potential for integrating FVS with DEBMOD depends on the standardization of use of DEBMOD (low as of 1995), the ability of DEBMOD to estimate debris from partial cuts (absent as of 1995), and the degree to which FVS output emulates that of a general stand exam (unknown). There is no doubt, however, that translating pest impacts (defoliation, mortality) into DEBMOD's stand and tree inputs would represent a significant breakthrough in terms of linking infestation damage to fire hazard.

1. Acronym and name: **DFINV** , Down Fuel Inventory System

2. **Brief Description:** Calculates the weight, volume, and depth of dead and downed woody material, using the planar intersect technique to collect data. See Intermountain Research Station pub. GTR INT-16, 1974, "Handbook for Inventoring Downed Woody Material."

3. **Geographical level of analysis** (P = primary and S = secondary)

Forestwide Subforest P Project

4. **Purpose of analysis** (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
P Ecosystem	Resource effects/Production	Other:

5. **Resource or function** (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	Wildlife
P Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. **Type of Tool.**

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. **Modeling techniques** (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. **Supporting software requirements.**

Operating system: DOS or Data General AOS/VS
Software package(s): Written in ASCII FORTRAN

9. **Hardware requirements.**

Computer: IBM or compatible microcomputer or Data General
Graphics Card:
Math co-processor:
Printer:
Other:

Disk Space:
RAM Space:
Mouse:
Plotter:

10. **Documentation/user support available.**

On-line help	User's Manual
X Publications	Updates
Training	Telephone Support

11. **Principal developer.**

James K. Brown/USDA Forest Service/Intermountain Research Station

Other:

12. For technical information, contact:

Name: Cam Johnston Title: Computer
Programmer/Analyst

Address: USDA Forest Service, Intermountain Research Address:
Station
Box 8089
Missoula, MT 59807

13. For acquisition information, contact:

Name: Same as above. Title:

Phone: (406)-329-4810 ext. FAX: ()- Phone: ()- ext.: FAX: ()-

E-mail Address: C.Johnston:S22L01A

Data General RIS file:
Acquisition Charge? X No Yes:

14. Additional description of tool.

DFINV does not seem to be widely used in the NF System. Since the program requires the user to input rather specific information regarding the plot to be analyzed, it is doubtful that opportunities for general integration with the FVS or pest models are very significant. Still, this model, like DEBMOD, provides a way of linking stand or tree conditions to the accumulation of fuels, which is a necessary step to incorporating fire hazard predictions in vegetation simulation programs. If DFINV could be sufficiently generalized to accommodate FVS output, while remaining specific enough to make accurate inventories, this could be a potentially significant linkage.

1. Acronym and name: FEIS , Fire Effects Information System

2. Brief Description: The system is a computerized knowledge processor to provide managers with easy access to the state-of-the-knowledge about effects of fire on plant species, plant communities, and animal species.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

S Subforest

P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

Cumulative Effects

Logging systems

Spatial

Economic/Financial

Monitoring

Transportation

P Ecosystem

S Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

S Wildlife

P Fire

Range

S Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

S AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

P Other: Information dissemination

8. Supporting software requirements.

Operating system: Data General AOS/VS II

Software package(s): Common LISP

9. Hardware requirements.

Computer: Data General

Graphics Card:

Math co-processor:

Printer:

Other:

Disk Space:

RAM Space:

Mouse:

Plotter:

10. Documentation/user support available.

On-line help

User's Manual

USDA Forest Service/Intermountain Research Station

Publications

Updates

Training

Telephone Support

11. Principal developer.

X Other: Research publications are in progress.

12. For technical information, contact:

Name: Cam Johnston Title: Computer Programmer/Analyst

Address: USDA Forest Service, Intermountain Research Station
Box 8089
Missoula, MT 59807

13. For acquisition information, contact:

Name: Same as above. Title:

Phone: (406)-329-4810 ext. FAX: ()- Phone: ()- ext.: FAX: ()-

E-mail Address: C.Johnston:S22L01A

Data General RIS file:
Acquisition Charge? X No Yes:

14. Additional description of tool.

FEIS was designed to help managers plan a prescribed fire to accomplish a desired plant response; rehabilitate disturbed land; prepare prescriptions for wilderness and natural areas; plan silvicultural, range, or wildlife habitat improvements; prepare vegetation management plans; write EIS's; and prepare recovery plans for T & E plant and animal species. It is an expert system with up-to-date information on the effects of fire on over 500 plants, 30 animals, and 10 plant ecosystems.

The only likely potential for integration of FEIS with pest management is to incorporate in FEIS the effects of various kinds, intensities, etc. of fire on habitat for forest insects and pathogens.

1. Acronym and name: FIREFAMILY , Fire Planning with Historic Weather Data

2. Brief Description: NFDRS provides indices to aid in broad scale fire management planning activities. FIREFAMILY performs statistical analysis on the historical weather to aid in planning efforts and to calibrate the NFDRS.

3. Geographical level of analysis (P = primary and S = secondary)

P Forestwide S Subforest Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	S Resource scheduling
Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
P Ecosystem	S Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	Wildlife
P Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

X Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	Simulation
Heuristic process	Mixed-integer programming	P Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: MVS
Software package(s): Also requires historical data from the National Interagency Fire Management Integrated Database (NIFMID).

9. Hardware requirements.

Computer: NCC-KC IBM or PC (386)
Graphics Card:
Math co-processor:
Printer:

Disk Space: 1 MB
RAM Space: 640 KB
Mouse: Yes
Plotter:

Other: Network connection via FTS-2000 from the DG to NCC-KC; or dial-in modem to NCC-KC via microcomputer.

10. Documentation/user support available.

On-line help	X User's Manual
X Publications	Updates

11. Principal developer.

Main, Paananen, and Burgan/USDA Forest Service/USDA Forest Service

X Training

X Telephone Support

Other:

12. For technical information, contact:

Name: Mike Barrowcliff **Title:** Systems Analyst

Address: USDA Forest Service, Fire & Aviation Management

P.O. Box 96090

Washington, DC 20090-6090

13. For acquisition information, contact:

Name: Same as above.

Title:

Address:

Phone: (202)-205-1503 ext.

FAX: (202)-205-1272

Phone: ()-

ext.:

FAX: ()-

E-mail Address: M.Barrowcliff:W01C

Data General RIS file:

Acquisition Charge?

X No

Yes:

14. Additional description of tool.

Subforest areas input daily weather observations that are stored in the historical database (NIFMID) at the USDA National Computer Center. FIREFAMILY generates statistical analyses, which will aid the fire planner in pre-suppression and suppression planning, as well as fine tuning the NFDRS. Indices are devised to be used for large-scale planning units (greater than 10,000 acres), not for site-specific projects. DOS version available for FIRDAT and SEASON (2 FIREFAMILY components) developed by California Dept. of Forestry.

In all likelihood, FIREFAMILY has no potential for integration with the FVS or pest extensions, since its emphasis is on historical data regarding weather and occurrences of fire.

1. Acronym and name: FOFEM , First Order Fire Effects Model

2. Brief Description: An integrated system to predict the effects of wildland fire on a variety of ecosystem components.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

	Budgeting	Legal documentation	Resource scheduling
S	Cumulative Effects	Logging systems	Spatial
	Economic/Financial	Monitoring	Transportation
P	Ecosystem	S Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

S	Air	Insect/Disease	Soils	Water
	Cultural	Minerals	Timber	Wildlife
P	Fire	Range	S Vegetation	Wilderness
	Fisheries	Recreation	Visual/Esthetics	
	All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

	AI/Expert systems	Integer programming	Network analysis
	Dynamic programming	Linear programming	P Simulation
S	Heuristic process	Mixed-integer programming	S Statistical
	Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system:
Software package(s):

9. Hardware requirements.

Computer: IBM-compatible PC or Data General
Graphics Card: NO

Math co-processor: YES
Printer:

Disk Space:10 MB
RAM Space: 4 MB
Mouse: NO
Plotter: No

Other:

10. Documentation/user support available.

X	On-line help	User's Manual
	Publications	Updates
	Training	Telephone Support

11. Principal developer.

Bob Keane, Elizabeth Reinhardt, James Brown/USDA Forest Service/Intermountain Fire Sciences Laboratory

Other:

12. For technical information, contact:

Name: Bob Keane Title: Research Ecologist
Address: USDA Forest Service, Intermountain Research Station
 Intermountain Fire Sciences Laboratory
 P.O. Box 8089, Missoula, MT 59807

13. For acquisition information, contact:

Name: Bob Keane Title: Research Ecologist
Address: Intermountain Fire Sciences Laboratory
 P.O. Box 8089
 Missoula, MT 59807

Phone: 406-329-4846 ext. :
E-mail Address: B.Keane:S22L01A

FAX: 406-329-4877

Phone: 406-329-4846 ext.: FAX: 406-329-4877

Data General RIS file: Host: S22L01A; Staff: FE; RIS: RIS: FOFEM.DMP
Acquisition Charge? X No Yes:

14. Additional description of tool.

FOFEM aids in development of fire prescriptions and in prediction of wildfire effects, including duff and woody fuel consumption, tree mortality, smoke production, soil exposure, and soil heating. It also forms the basis for predicting secondary fire effects such as tree regeneration, hydrologic changes, soil erosion, and vegetation succession. User inputs include fuel loading data (FOFEM can link with a number of fuel loading models), fuel moisture, stand structure and composition, and fire behavior (flame length, scorch height). FOFEM is included in the ECOPAC collection of programs to perform analysis on ECODATA plots. In addition to predicting fire effects, FOFEM also has a planning module that allows the user to specify desired fire effects and to tailor fire prescriptions to achieve those effects.

Potential for integration with FVS and pest extensions is so great that it is being done! The plan is to tie fire effects into the Integrated Pine Beetle Model, replacing the provisional fire effects model IPBM contains already with FOFEM and fuel dynamic models. Those interested in learning more about the specific linkages envisioned and the progress made in their formation should contact Elizabeth Reinhardt at the Intermountain Fire Sciences Laboratory in Missoula, MT.

1. Acronym and name: NFDRS , National Fire Danger Rating System

2. Brief Description: NFDRS provides indices to aid in broad scale fire management planning activities. The system utilizes current fire weather to derive indices that relate to potential fire occurrence and behavior.

3. Geographical level of analysis (P = primary and S = secondary)

P Forestwide

S Subforest

Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

S Resource scheduling

Cumulative Effects

Logging systems

Spatial

Economic/Financial

Monitoring

Transportation

P Ecosystem

S Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

Wildlife

P Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

S Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system:

Software package(s): Also requires historical data from the National Interagency Fire Management Integrated Database (NIFMID), analyzed with FIREFAMILY to calibrate the system.

9. Hardware requirements.

Computer: NCC-KC IBM or PC (386)

Graphics Card:

Math co-processor: YES

Printer:

Disk Space:1 MB

RAM Space: 640 K

Mouse: NO

Plotter: NO

Other: Network connection via FTS-2000 from the DG to NCC-KC or dial-in modem to NCC-KC via microcomputer.

10. Documentation/user support available.

X On-line help

X User's Manual

11. Principal developer.

Deeming, Burgan, and Cohen/USDA Forest Service

X Publications Updates
 X Training X Telephone Support
 Other:

12. For technical information, contact:

Name: Mike Barrowcliff Title: Systems Analyst
 Address: USDA Forest Service, Fire & Aviation Management
 P.O. Box 96090
 Washington, DC 20090-6090

13. For acquisition information, contact:

Name: Same as above. Title:
 Address:

Phone: (202)-205-1503 ext. : FAX: (202)-205-1272
 Phone: ()- ext.: FAX: ()-

E-mail Address: M.Barrowcliff:W01C

Data General RIS file:
 Acquisition Charge? X No Yes:

14. Additional description of tool.

Subforest areas input daily weather observations, which are used to generate cumulative fire danger rating indices and utilized by the National Weather Service to produce forecasted weather indices. Forest area fire managers use the NFDRS for pre-positioning of suppression resources. Indices are devised to be used on large scale planning units (greater than 10,000 acres in size), not on site-specific projects.

NFDRS works in conjunction with WIMS, which houses the most up-to-the-minute weather information, and FIREFAMILY, which performs statistical analysis on the historic patterns of fire weather and fire occurrence. The driving factors for fire danger rating are, of course, weather and the condition (moisture, basically) of the prevailing vegetation. The seasonal variation inherent in these factors makes integration with the FVS and pest models somewhat difficult, but to the extent that fuel build-ups occur over many years in the absence of stand-replacing fires, there is potential for progress in this area. Fuels are incorporated into NFDRS through the 20 broad-scale fuel models, lettered A through U, detailed by Anderson, GTR INT-122, 1982; Deeming et al., GTR INT-39, 1977; and Deeming and Brown, J. Forestry 73: 347-350, 1975. NFDRS is used nationwide as the primary tool for determining the potential for wildfire.

1. Acronym and name: RERAP , Rare Event Risk Assessment Process

2. Brief Description: RERAP calculates the risk of long-term fire movement, focusing on rare and significant spread events and fire-ending weather events. It can also be used to assess the risk of receiving significant smoke events.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

S	Air	Insect/Disease	Soils	Water
	Cultural	Minerals	Timber	Wildlife
P	Fire	Range	Vegetation	Wilderness
	Fisheries	Recreation	Visual/Esthetics	
	All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	X	Spreadsheet Application
GIS Application		Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	S Simulation
Heuristic process	Mixed-integer programming	P Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS 4.0 or higher
Software package(s): QuattroPro for DOS, 4.0 or 5.0.
Windows version scheduled for Fall 95 release.
(Weather data processing with NIFMID (WIMS),
PCFIRDAT, and PCSEASON is required. A fire
behavior program such as BEHAVE may be helpful,
too.)

9. Hardware requirements.

Computer: IBM-compatible PC, 386 or higher, 486DX suggested	
Graphics Card: No	Disk Space:
	RAM Space: 640 K
Math co-processor: Yes	Mouse: No
Printer: Non-postscript	Plotter: No

Other: Recommended use of expanded memory.

10. Documentation/user support available.

11. Principal developer.

On-line help	X	User's Manual	Donald Carlton and Marc Wiitala/USDA Forest Service, Pacific Northwest Region
Publications		Updates	
Training		Telephone Support	
Other:			

12. For technical information, contact:

Name: Don Carlton or Marc Wiitala Title: Fire Planning Specialist

Address: USDA Forest Service, Pacific Northwest Region

333 S.W. 1st Ave., P.O. Box 3623

Portland, OR 97208

13. For acquisition information, contact:

Name: Same as above Title:

Address:

Phone: (503)-326-4931 ext.

FAX: (503)-326-5186

Phone:

ext.:

FAX:

E-mail Address: D.Carlton:R06C

Data General RIS file:

Acquisition Charge?

No

Yes:

14. Additional description of tool.

RERAP is intended for use by fire managers to estimate the risk associated with prescribed natural fires, management-ignited prescribed fires, or wildfires. The process utilizes 3 separate-yet-linked spreadsheets: SPREAD30, TERM30, and RISK30. SPREAD30 provides the user with a systematic way of estimating average daily fire movement and "rare and significant" fire spread frequencies and distances. In addition to standard fuel and slope inputs, the SPREAD process requires the PCFIRDAT and PCSEASON programs to process weather data. It can also incorporate the spread-rate predictions from a Fire Behavior Program such as BEHAVE. It outputs (for up to 5 time periods) an expected spread distance, a rare event frequency, and the additional spread from a rare event. TERM30 quantifies a probability distribution for a fire-ending event by fitting a Weibull cumulative distribution curve to an empirical frequency distribution built from historical weather data. RISK30 is the probability calculation tool for making long-term fire movement or smoke episode risk estimates. It takes the probability distribution for a fire-ending event fitted in TERM, the rare and significant fire spread event frequencies derived in SPREAD, and computes fire movement or smoke event probabilities, broken down by common risk and rare and significant risk. No geographic limitations for RERAP are specified.

Fuels information is incorporated into RERAP via the FBO fuel models used in BEHAVE. Since most of the other inputs to RERAP relate to specific events rather than conditions, there is limited potential for integrating veg. info from the FVS into RERAP. However, the general risks and probabilities modelled in RERAP could be applied to the risks and probabilities associated with new outbreaks of pest infestations or spread of existing ones.

1. Acronym and name: **SASEM** , Simple Approach Smoke Estimation Model

2. Brief Description: A screening tool for analyzing air quality impacts (PM10, particulates <= 10 microns; reduction in visual range due to smoke) of controlled burns on federal lands.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

	Budgeting	Legal documentation	Resource scheduling
S	Cumulative Effects	Logging systems	Spatial
	Economic/Financial	Monitoring	Transportation
	Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

P	Air	Insect/Disease	Soils	Water
	Cultural	Minerals	S Timber	Wildlife
S	Fire	S Range	Vegetation	Wilderness
	Fisheries	Recreation	S Visual/Esthetics	
	All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: MS/DOS
Software package(s):

9. Hardware requirements.

Computer: IBM-compatible PC (for minis, mainframes, & Macs--see M. Sestak)
Graphics Card: Disk Space: 700 KB
 RAM Space: 640 KB
Math co-processor: Useful Mouse:
Printer: Plotter:

Other: Can be recompiled on virtually any system with a Fortran 77 compiler

10. Documentation/user support available.

X	On-line help	X	User's Manual
X	Publications	X	Updates
X	Training	X	Telephone Support

11. Principal developer.

Mike Sestak and Al Riebau/U.S. Bureau of Land Management, Wyoming State Office

X Other: Updates are occasional; telephone support is informal.

12. For technical information, contact:

Name: Michael Sestak Title: Bioclimatologist
Address: National Biological Service, Environmental Science & Tech. Center
2401 Research Boulevard, Suite 205
Fort Collins, CO 80526-1826

13. For acquisition information, contact:

Name: Same as above Title:

Address:

Phone: (303)-221-4873 ext. :

FAX: (303)-491-2207

Phone: ext.:

FAX:

E-mail Address: Mikese@storm.cnr.colostate.edu

Data General RIS file:

Acquisition Charge? X No Yes:

14. Additional description of tool.

SASEM was designed for use by those with general technical background and knowledge of fire management, but without special training in air quality. It is intended to provide a quick, relatively clear yes/no decision about whether a prescribed burn should be permitted. Model outputs include (1) the maximum particulate concentration and distance from the fire at which this concentration would occur; (2) indication of whether ambient concentration standards would be exceeded and, if so, over what range of distances; (3) two estimates of the minimum visual range expected. These are accomplished through calculation of fuel consumption, a particulate emission factor, plume rise, ambient concentration, and visual range. SASEM considers the 'plant boundary' of a prescribed burn to be 1 km from the fire; no impacts are reported within this 1-km boundary. Inputs include basic prescribed fire inputs such as fuel type, fuel loading, expected fire intensity, area and duration of burn, average wind speed, etc. Concentrations are compared to national standards. If local standards differ, this must be taken into account in interpreting model results; otherwise, there are no geographic limitations to the model.

Potential for integration with FVS and pest models is limited, unless prescribed burns are considered as possible treatment for infested stands. Development of dynamic fuel loading models--tied to the FVS--would allow determination of loads in future stands, but specific emission results ultimately depend more on day-to-day variables such as windspeed.

1. Acronym and name: WIMS , Weather Information Management System

2. Brief Description: WIMS is a comprehensive system to manage forestry weather information nationwide, used primarily to support fire management activities.

3. Geographical level of analysis (P = primary and S = secondary)

P Forestwide Subforest Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	S	Legal documentation	Resource scheduling
Cumulative Effects		Logging systems	Spatial
Economic/Financial	S	Monitoring	Transportation
S Ecosystem	P	Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	Wildlife
S Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	P Other: Weather	

6. Type of Tool.

X Database Application	Spreadsheet Application
GIS Application	Computer program

7. Modeling techniques (P = primary and S = secondary)

S AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	Simulation
Heuristic process	Mixed-integer programming	P Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: IBM/MVS (CICS)
Software package(s): Oracle SQL*Forms, "C"

9. Hardware requirements.

Computer: 3270-terminal emulator;file transfer w/DG or PC w/SimWare SimPC	
Graphics Card:	Disk Space:
	RAM Space:
Math co-processor:	Mouse:
Printer:	Plotter:
Other:	

10. Documentation/user support available.

X On-line help	X User's Manual
X Publications	X Updates
X Training	X Telephone Support
Other:	

11. Principal developer.

USDA Forest Service

12. For technical information, contact:

13. For acquisition information, contact:

Name: Mike Barrowcliff	Title: Systems Analyst	Name: same as above	Title:
Address: USDA Forest Service, Fire & Aviation Management	Address:		
P.O. Box 96090			
Washington, DC 20090-6090			

Phone: (202)-205-1503	ext.:	FAX: (202)-205-1272	Phone:	ext.:	FAX:
E-mail Address: M.Barrowcliff:W01C			Data General RIS file:		
			Acquisition Charge?	No	Yes:

14. Additional description of tool.

WIMS provides timely access to weather data and related weather information, efficient tools for data management, and a supportive interactive user interface. Weather data has been used primarily to support fire management activities such as presuppression planning and allocating fire fighting resources, as well as to provide information to the public. Beyond this, however, WIMS is an attempt to collect and analyze weather information in such a way as to support other resource needs, such as Ecosystem Management. Through a direct link to the National Weather Service, WIMS gets selected forecasts and graphics from NWS and transmits periodic weather observations and Fire Danger Rating bulletins. Another link allows WIMS to receive Remote Automatic Weather Station (RAWS) observations from the BLM. All this weather data is made available by WIMS in a near-real-time environment. In addition, WIMS users also have access to historic fire weather and occurrence data housed in the National Interagency Fire Management Incorporated Database (NIFMID). WIMS is accessible via FTS2000 direct dial-up and/or X.25 packet-switched service to the National Computer Center in Kansas City. Any 3270-terminal emulator can communicate with WIMS, but file-transfer is supported only on the DG and on the PC (using SimWare's SimPC application).

In its current usage, WIMS has limited potential for integration with FVS or pest models. Veg. info. is incorporated in the Fire Danger Rating System through fuel models; weather is the variable vegetation and pests can't really affect. However, the efforts to incorporate weather management into other resource needs beyond fire--recreation would be an obvious resource affected--and into Ecosystem Management in general, suggests that the possibility of using WIMS to assess the effects of weather on the initiation and spread of pest epidemics could be on the horizon.

1. Acronym and name: BIRDHAB , Southern Region Bird Habitat Relationships Matrices

2. Brief Description: BIRDHAB uses spatial and tabular data found in the Forest Service corporate database to develop qualitative assessment of habitat for 259 species of forest-dwelling birds occurring in the South.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

S Subforest

P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

S Cumulative Effects

Logging systems

S Spatial

Economic/Financial

S Monitoring

Transportation

Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

P Wildlife

Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

X Database Application

Spreadsheet Application

X GIS Application

Computer program

7. Modeling techniques (P = primary and S = secondary)

P AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: UNIX

Software package(s): Arc/Info 6.1, Oracle 6.0 and SQL forms 3.0, CISC Oracle, and R8 GIS database.

9. Hardware requirements.

Computer: UNIX workstation

Graphics Card:

Math co-processor:

Printer:

Disk Space:4.5 MB

RAM Space:

Mouse:

Plotter:

Other:

10. Documentation/user support available.

On-line help

User's Manual

X Publications

X Updates

X Training

X Telephone Support

11. Principal developer.

Jim Fenwood/USDA Forest Service/Southern Region Paul Hamel/Tennessee Dept. of Conservation

Other:

12. For technical information, contact:

Name: Marilyn Robertson Title: Regional Wildlife Ecologist

Address: USDA Forest Service, Southern Region

Suite 816N, 1720 Peachtree Road NW.

Atlanta, GA 30367

13. For acquisition information, contact:

Name: Same as above.

Title:

Address:

Phone: (404)-347-4060 ext.

FAX: (404)-347-4448

Phone: ()-

ext.:

FAX: ()-

E-mail Address: M.Roberston:R08B

Data General RIS file:

Acquisition Charge?

No

X

Yes: Send blank floppy

14. Additional description of tool.

BIRDHAB relates the expected occurrence of a species with the elements of habitat—namely cover type and successional stage. It is based on a hardcopy version by Hamel: "Land Manager's Guide to the Birds of the South" (The Nature Conservancy, 1992). It is intended for spatial analysis of project-level impacts on avian fauna. User can choose to query a list of species based on a specified amount of habitat or query the habitat quality for a given species or group of species.

The habitat information BIRDHAB provides is qualitative (optimal, suitable, etc.), although plans to make it quantitative are in the works. Vegetation data inputs come from the R8 CISC (Continuous Inventory of Stand Conditions), and include forest type and condition class. The region developed cross-walk tables to link CISC's forest types to Hamel's cover types, and CISC's condition classes to Hamel's successional stages. The model is limited to birds and to Region 8; however, the ability to evaluate habitat for several species at once, as well as its links with regional veg. data, make it a fairly significant model in terms of FVS and pest model integration.

1. Acronym and name: CALWHRS , California Wildlife Habitat Relationships System

2. Brief Description: CALWHRS is a tool for performing word-level HEP analysis for California terrestrial vertebrates in any California habitat.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

P Subforest

S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

S Cumulative Effects

Logging systems

Spatial

Economic/Financial

Monitoring

Transportation

S Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

P Wildlife

Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

X Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS 2.0+

Software package(s): Self contained (Clipper compiler)
or could use dBase IV

9. Hardware requirements.

Computer: IBM or compatible microcomputer

Graphics Card: CGA+

Math co-processor: Yes

Printer: Epson dot matri

Disk Space:20MB
RAM Space: 640KB
Mouse:
Plotter:

Other:

10. Documentation/user support available.

X On-line help

X User's Manual

X Publications

X Updates

Training

Telephone Support

11. Principal developer.

California Interagency Wildlife Task Group/Irene Timossi and Reginald Barrett,
Univ. of California @ Berkeley

Other:

12. For technical information, contact:

Name: Barry Garrison Title: WHR Coordinator

Address: California Dept. of Fish and Game

1416 Ninth Street

Sacramento, CA 95814

13. For acquisition information, contact:

Name: Pat Manley

Title: Regional Wildlife Ecologist

Address: USDA Forest Service, Pacific Southwest Region

630 Sansome Street

San Francisco, CA 94111

Phone: (916)-653-1738 ext. :

FAX: (916)-653-1019

Phone: (415)-705-1168 ext.:

FAX: ()-

E-mail Address:

Data General RIS file:

Acquisition Charge? X No Yes:

14. Additional description of tool.

The database contains information for 643 terrestrial vertebrate species occurring in California. Through various queries, the user can get reports on all available information for a single species, on all species possibly present in a single set of conditions, comparing two sets of conditions for a select list of species, etc. This is a complete set of tools, including several volumes and a computer database.

Potential for integration with FVS and pest models depends, in part, on the future "spread" of this modelling concept to other regions. As of 1995, only Region 5 has a fully operational wildlife habitat relationship system for all vertebrate species; however efforts in Region 6 (HABSCAPES) and in Region 8 (BIRDHAB) also follow the same general approach of applying a matrix based on the opinions of biologists on what constitutes optimal, suitable, marginal, and non-suitable habitat for wildlife. (These two models are newer than California's, and are likely to grow in use in the next few years.) Certainly the appeal of a "one-system-does-it-all" approach in terms of potential for integration is hard to overlook. There are questions about the validity of some of the habitat predictions of the CALWVHRS model that may jeopardize its future use (and the spread of the modelling approach). On the other hand, the well-regarded KLEMS (Klamath Ecosystem Management System) effort does successfully hook in to this system in its habitat evaluation, so perhaps the "bugs" are being worked out. Veg. data comes from the region's timber database. An associated program, GROWILD, projects habitat under future management scenarios.

1. Acronym and name: ELK COVER ,

2. Brief Description: ELK COVER is a computer simulation model that determines security cover of forest stands from stand inventory data or PROGNOSIS simulations.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	S Timber	P Wildlife
Fire	Range	S Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: AOS/VS; DOS; UNIX
Software package(s):

9. Hardware requirements.

Computer: Data General; IBM or compatible microcomputer; UNIX	
Graphics Card:	Disk Space:
	RAM Space:
Math co-processor:	Mouse:
Printer:	Plotter:
Other:	

10. Documentation/user support available.

On-line help	User's Manual
X Publications	Updates
Training	Telephone Support

11. Principal developer.

Frederick Smith/Colorado State University/Dept. of Forest Sciences James H. Long/Utah State University/Dept. of Forestry

Other:

12. For technical information, contact:

Name: Frederick Smith Title: Professor
Address: Department of Forest Sciences

Colorado State University
Fort Collins, CO 80523

13. For acquisition information, contact:

Name: Rich Teck Title: Operations Research Analyst
Address: USDA Forest Service, Washington Office, Timber Mgmt. Service
Center
3825 East Mulberry
Fort Collins, CO 90524

Phone: (303)-491-7505 ext.
:

FAX: (303)-491-
6754

Phone: (303)-498-1772 ext.:

FAX: (303)-498-1660

E-mail Address: skip(A)abies.ctnr.colosta

Data General RIS file:

Acquisition Charge? X No

Yes:

14. Additional description of tool.

As is obvious from its brief description, ELK COVER is able to integrate PROGNOSIS output in its predictions of security cover. It might, therefore, serve as a model for how to form many of the links between vegetation modelling routines and habitat models. However, its limited application (security cover only, and only in relation to a single species) makes it a low priority for integration with pest models.

1. Acronym and name: GROWILD ,

2. Brief Description: A computer program associated with the California WHR system that allows the user to analyze effects of management activities on habitat for selected wildlife species.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air.	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	P Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS 5.0 or higher
Software package(s):

9. Hardware requirements.

Computer: IBM-compatible PC, 486 recommended

Graphics Card: YES

Math co-processor: 8087/287/387

Printer:

Other:

Disk Space: 10 MB
RAM Space: 350 KB
Mouse:
Plotter:

10. Documentation/user support available.

X On-line help	X User's Manual
X Publications	Updates
X Training	X Telephone Support

11. Principal developer.

Irene Timossi and Reginald Barrett/University of California @ Berkeley

Other:

12. For technical information, contact:

Name: Barry Garrison Title: WHR Coordinator
Address: California Department of Fish & Game

1416 Ninth Street
Sacramento, CA 95814

13. For acquisition information, contact:

Name: Pat Manley Title: Regional Wildlife Ecologist
Address: USDA Forest Service, Pacific Southwest Region

630 Sansome Street
San Francisco, CA 94111

Phone: 916-653-1738 ext.: FAX: 916-653-1019 Phone: 415-705-1168 ext.: FAX:

E-mail Address:

Data General RIS file:

Acquisition Charge? X No Yes:

14. Additional description of tool.

User inputs landtype, successional path, current inventory (vegetation), selected species for habitat evaluation, specified set of harvest parameters (including number of rotations and rotation age, if applicable), size of management-created openings, and simulation period (from 1 to 12 decades). Output includes habitat suitability values, acres of optimal and suitable habitat, and changes in different seral stages for each habitat over time.

Like the California WHR system to which it is tied, GROWILD is limited to the boundaries of the state in its geographic analysis. The user's specification of a likely successional stage and alternative harvest parameters represents an attempt to model the effects of re-vegetation on wildlife habitat. This is where a vegetation simulation model could be connected to allow the user access to more quantitative (and probably more accurate) data concerning the likely progressions of structural stages. As mentioned in the discussion of the CALWHRS model, the potential importance of such integration ultimately depends on whether the WHR modelling approach gains more acceptance nationwide, or whether it remains largely the state's private domain.

1. Acronym and name: HABSCAPES , Habitat Analysis of Landscapes

2. Brief Description: HABSCAPES is composed of a Wildlife Habitat Relationships database and compiled FORTRAN programs used to analyze wildlife habitat at the landscape scale based on the amount and distribution of communities and structural stages.

3. Geographical level of analysis (P = primary and S = secondary)

P Forestwide S Subforest Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	S Spatial
Economic/Financial	S Monitoring	Transportation
S Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	P Wildlife
Fire	Range	S Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

X Database Application	Spreadsheet Application
X GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS 3.0 or higher
Software package(s): Paradox for DOS, 4.0 or higher

9. Hardware requirements.

Computer: IBM compatible PC: 386, 486, or Pentium

Graphics Card:

Math co-processor:

Printer:

Disk Space: 5 MB
RAM Space: 8 MB
Mouse:
Plotter:

Other: Paradox requires free disk space about 3 times the size of the largest table to process queries.

10. Documentation/user support available.

On-line help	X	User's Manual
X Publications	X	Updates
X Training	X	Telephone Support

11. Principal developer.

Kim Mellen and Rich Hagedstedt/USDA Forest Service, Mt. Hood National Forest; Mark Huff/USDA Forest Service, Pacific Northwest Research Station

Other:

12. For technical information, contact:

Name: Rich Hagedt Title: Forest Analyst
Address: USDA Forest Service, Mt. Hood National Forest

2955 NW Division Street
Gresham, OR 97030

13. For acquisition information, contact:

Name: Kim Mellen Title: Wildlife Ecologist
Address: USDA Forest Service, Mt. Hood National Forest

2955 NW Division Street
Gresham, OR 97030

Phone: (503)-666-0712 ext.
:

FAX: (503)-666-0641

Phone: (503)-666-0670 ext.:

FAX: (503)-666-0641

E-mail Address: R.Hagedt:R06F06A

Data General R I S file :
R06F06A:STAFF:ECOLOGY:WILDECOL:SCCA:WHRPROG.EXE and
WHRDATA.EXE

Acquisition Charge? X No Yes:

14. Additional description of tool.

HABSCAPES is used primarily at the forest scale to assess distribution of wildlife habitat across the forest. Watershed analysis teams have tiered to the forest level analysis to compare wildlife habitat in a given watershed to habitat across the forest and to develop a species list for the area. The analysis was originally designed to assess habitat for all terrestrial vertebrates on a forest or analysis area by grouping species into guilds based on how they would be expected to react to different amounts and distributions of habitats across the landscape. The model uses information on minimum patch size, home range size, and amount of the home range in suitable habitat to analyze suitability of habitats across the analysis area. The model can also be run for individual species of interest. The wildlife habitat relationships (WHR) database is used to group species into guilds and to query for habitat relationships of individual species. A vegetation database should be developed using the same habitat classification as that in the WHR database so that the 2 databases can be directly linked. The model can be run on historic, current, and predicted future landscapes to assess trends in habitat through time.

The vegetative inputs come from MOMs (Mature & Over-Mature inventory data), MOSS, and OSIS, and are imported into a Paradox database using UTOOLS. The model originated on the Mt. Hood NF; other forests gearing up to participate include the Mt. Baker/Snoqualmie, the Gifford Pinchot, the Willamette, and the Siuslaw. Fitting a forest's data to the format of the WHR database is an essential first step; until this is accomplished for a significant number of forests, plans to integrate with dynamic veg. simulation models must be put on hold.

1. Acronym and name: HABSIM , R8 Habitat Capability Models

2. Brief Description: HABSIM provides quantitative analysis of habitat capability for terrestrial fauna. It resides within the COMPATS shell.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

P Subforest

S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

S Cumulative Effects

Logging systems

Spatial

Economic/Financial

S Monitoring

Transportation

Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

P Wildlife

Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

X Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: Data General AOS/VS

Software package(s): Oracle, CISCII (for automatic stand data retrieval)

9. Hardware requirements.

Computer: Data General MV Series

Graphics Card:

Math co-processor:

Printer:

Disk Space:

RAM Space:

Mouse:

Plotter:

Other:

10. Documentation/user support available.

X On-line help

X User's Manual

Publications

X Updates

X Training

X Telephone Support

11. Principal developer.

Eddie Morris, James Ferwood, and Dan Keller/USDA Forest Service/Southern Region

Other:

12. For technical information, contact:

Name: Marilyn Robertson Title: Regional Wildlife Ecologist

Address: USDA Forest Service

1720 Peachtree Road, NW., Suite 816N

Atlanta, GA 30367

13. For acquisition information, contact:

Name: Same as above

Title:

Address:

Phone: (404)347-4060 ext. :

FAX: (404)-347-4448

Phone:

ext.:

FAX:

E-mail Address: M.Robertson:R08B

Data General RIS file:

Acquisition Charge?

No

X

Yes:

14. Additional description of tool.

HABSIM is used primarily as a project-level analysis tool. Outputs express theoretical maximum number of animals potentially supported in an area and should only be used to compare alternatives within a given project. Outputs are relative, not absolute, and also may be used for forest-level TSPIRS output predictions. HABSIM links to CISC stand data, and future links are planned to road models and sediment models. Multiperiod predictions are possible. This tool is specific to Region 8, and the coefficients are forest-specific and must be developed for each forest type and age-class combination. Spatial arrangements of stands within an analysis area are not considered.

HABSIM runs off CISC stand data, which means that forest type and age class are the driving veg. data. Coefficients that relate a specific type-age combination to either potential number of animals, habitat capability index, or other habitat parameters (like snags or mast) drive the model, much like the wildlife habitat relationships matrix of a WHR-type model drives its analysis. Much of the development of these coefficients represents the consensus opinion of biologists familiar with the given species; it is important to keep in mind that this "professional judgment" element will remain essential in wildlife habitat modelling even when FVS and pest models are integrated. HABSIM resides in the COMPATS shell. Because Region 8 has expressed great interest in integrating the various kinds of forest data (timber, habitat, sediment, scenery, etc.), this may well be a good place to begin investigating links with dynamic vegetation simulations. A good contact would be the Regional Wildlife Ecologist, Marilyn Robertson--she's at 404-347-4081.

1. Acronym and name: HEICALC/HEIWEST , Elk Habitat Effectiveness Index

2. Brief Description: These programs identify the habitat effectiveness index (HEI) as a measure of the quality of elk habitat in a specific area. HEICALC applies to the Blue Mountains of Eastern Oregon and Washington, and HEIWEST applies to Western Oregon.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide

S Subforest

P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

Cumulative Effects

Logging systems

S Spatial

Economic/Financial

Monitoring

Transportation

S Ecosystem

Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

P Wildlife

Fire

Range

S

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS 2.0 or later

Software package(s): UTOOLS can be used to directly generate input for the HEI programs.

9. Hardware requirements.

Computer: IBM or compatible microcomputer 80286 or above

Graphics Card:

Math co-processor: Optional

Printer:

Other:

Disk Space:1MB

RAM Space: 540KB

Mouse: Optional

Plotter:

10. Documentation/user support available.

On-line help

X

User's Manual

Publications

Updates

Training

Telephone Support

11. Principal developer.

Alan Ager/USDA Forest Service/Umatilla National Forest Mark Hitchcock/Sedro Woolley, WA

X Other: Example data sets and documentation are included with the program.

12. For technical information, contact:

Name: Alan Ager Title: Analyst
Address: USDA Forest Service, Umatilla National Forest

 2517 SW. Hailey Avenue
 Pendleton, OR 97801

13. For acquisition information, contact:

Name: Bill Connolly Title: Analyst
Address: USDA Forest Service, Pacific Northwest Region

 P.O. Box 3623
 Portland, OR 97208-3623

Phone: (503)-278-3740 ext.

FAX: (503)-276-3811

Phone: (503)-326-7770 ext.:

FAX: (503)-326-7742

E-mail Address: A.Ager:R06F14A

Data General RIS file: R06A:STAFF:PEA:MERZ:PROGRAMS:HEI.EXE
These are also available from the Fort Collins Info Center in t
Acquisition Charge? X No Yes:

14. Additional description of tool.

HEICALC evaluates the spatial proximity of forage, marginal and satisfactory cover, and harvest treatment areas. HEIWEST evaluates the spatial proximity of forage, three types of cover (optimal, hiding, and thermal), and various effects of silvicultural treatments and fertilization for forage production. From these spatial relationships, several indices are developed to identify the quality of elk habitat. HEICALC is based primarily on Report PNW-GTR-218 "Habitat Effectiveness Index for on Blue Mountain Winter Ranges" (Thomas, et al. 1988). HEIWEST is based primarily on Report R6-F&WL-216-1986 "A Model to Evaluate Elk Habitat in Western Oregon" (Wisdom, et al. 1986). The first is available from the Pacific Northwest Experiment Station, P.O. Box 3890, Portland, OR 97208. The second report is available from USDA Forest Service, Pacific Northwest Station, Fish and Wildlife, P.O. Box 3623, Portland, OR 97208.

HEI evaluation is similar to HSI analysis in that it is single-species oriented. In these models, the degree of specificity in terms of vegetation-habitat linkages is often quite high. However, the geographic limitations and single-species approach suggest that these models probably have low priority in terms of integration with forest vegetation simulation and pest models.

1. Acronym and name: HIDE2 ,

2. Brief Description: HIDE2 assists in predicting hiding cover for elk, given tree density and diameter.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	P Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS; Data General AOS/VS
Software package(s): Basic

9. Hardware requirements.

Computer: IBM or compatible microcomputer; Data General	
Graphics Card: Not Hercules	Disk Space:10KB
	RAM Space:
Math co-processor:	Mouse:
Printer:	Plotter:
Other:	

10. Documentation/user support available.

On-line help	User's Manual
X Publications	Updates
Training	Telephone Support

11. Principal developer.

L. Jack Lyon/USDA Forest Service/Intermountain Research Station

X Other: Program graphics are self-explanatory.

12. For technical information, contact:

Name: L. Jack Lyon Title: Project Leader
Address: USDA Forest Service, Intermountain Research Station
P.O. Box 8089
Missoula, MT 59807

13. For acquisition information, contact:

Name: Same as above. Title:

Address:

Phone: (406) 721-5694 ext.

FAX: ()-

Phone: ()-

ext.:

FAX: ()-

E-mail Address: J.Lyon:S22L01A

Data General RIS file: None - request directly.

Acquisition Charge? No X Yes: Replacement of floppy disk

14. Additional description of tool.

HIDE2 is a computer program in which tree density and diameter are specified by the user. Stems are randomly "planted," and an arcsine transformation calculation is used to determine stem projection at 200 feet. Coverage at that distance is "visual blockage." Coverage of 65-inch segments at that distance is "hiding cover" for elk when a segment is 90 percent blocked. The pc version displays the tree stand graphically.

Use inputs, diameter and tree density, are easily obtainable from PROGNOSIS, as the ELK COVER model demonstrates. Like the ELK COVER model, then, HIDE 2 is a model where integration would be fairly easy, but because of the species limitations (and the fact that cover is the only habitat element modelled), not terribly useful.

1. Acronym and name: HIDE2X , A Program Designed to Calculate Hiding Cover Values

2. Brief Description: HIDE2X is a variation of HIDE2, designed to calculate hiding cover values for any size animal, given information about the timber stand being evaluated.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

P Subforest

S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

S Cumulative Effects

Logging systems

Spatial

Economic/Financial

Monitoring

Transportation

Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

P Wildlife

Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

S Other: Monte Carlo simulation

8. Supporting software requirements.

Operating system: Data General AOS/VS

Software package(s):

9. Hardware requirements.

Computer: Data General Eclipse Series

Graphics Card:

Math co-processor:

Printer: DG laser

Other:

Disk Space: Variable

RAM Space: Variable

Mouse:

Plotter:

10. Documentation/user support available.

X On-line help

X User's Manual

X Publications

Updates

Training

X Telephone Support

11. Principal developer.

Jerry Haugen/USDA Forest Service/Winema National Forest

X Other: DG mail support via J.Haugen

12. For technical information, contact:

Name: Jerry Haugen Title: Operations Research Analyst

Address: USDA Forest Service, Winema National Forest

2819 Dahlia Street

Klamath Falls, OR 97601

13. For acquisition information, contact:

Name: Same as above.

Title:

Address:

Phone: (503)-883-6726 ext.

FAX: (503)-883-6709

Phone: ()-

ext.:

FAX: ()-

E-mail Address: J.Haugen:R06F20A

Data General RIS file: Contact J.Haugen:R06F20A for a user's guide that includes acquisition/installation instructions.

Acquisition Charge? X No Yes:

14. Additional description of tool.

HIDE2X was used on the Winema National Forest to calculate hiding cover values for every stand condition in our FORPLAN timber tables. These values were then used to create a hiding cover output within FORPLAN. The model can also be used to calculate hiding cover values for specific timber stands during development of projects to ascertain compliance with Forest Plan direction. The expected user would be a district wildlife biologist. Data input includes the type of animal being evaluated (elk, deer, moose) and diameter and density of objects blocking the field of view through the stand (usually tree stems, but could include crowns of trees, shrubs, clumps of trees, rocks, or anything else). Outputs are the mean hiding cover and the standard error of the estimate. HIDE2X differs from HIDE2 as follows: accepts any size animal, not just elk; allows direct entry of diameters to 9,999 inches, so clumps of trees or other objects can be modeled; allows batch data entry; allows results to be saved; provides CEO-like data entry screens and is menu driven. HIDE2 has been field tested and determined to provide accurate results at a fraction of the expense of direct field measurement.

Potential for integration with FVS and pest models is higher with HIDE2X than with HIDE2, if for no other reason than this model's greater versatility. Still, cover is but one important component of habitat, and is only really important to the harvestable species (deer, elk, etc.) that probably receive a disproportionate share of modelling attention already because of their economic value. Developing links to HIDE2X won't help with biodiversity assessments, threatened & endangered species analysis, etc. For these reasons, it is suggested that efforts to integrate veg. and habitat models be directed elsewhere (WHR models, HABCAP models) first.

1. Acronym and name: HSI , Habitat Suitability Index Models 2.0

2. Brief Description: HSI models are available for approximately 150 species. These models were developed by the U.S. Fish and Wildlife Service and are used to evaluate habitat quality for wildlife species.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide P Subforest S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	P Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-Integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS

Software package(s):

9. Hardware requirements.

Computer: IBM or compatible microcomputer

Graphics Card:

Math co-processor:

Printer:

Other:

Disk Space:
RAM Space: 256KB
Mouse:
Plotter:

10. Documentation/user support available.

X On-line help	X User's Manual
X Publications	X Updates
X Training	X Telephone Support

11. Principal developer.

U.S. Fish and Wildlife Service

Other:

12. For technical information, contact:

Name: Warren Mangus Title:
Address: U.S. Fish and Wildlife Service

4512 McMurray Avenue
Fort Collins, CO 80525

13. For acquisition information, contact:

Name: Same as above Title:
Address:

Phone: (303)-226-9293 ext. FAX: ()- Phone: ()- ext.: FAX: ()-

E-mail Address:

Data General RIS file:
Acquisition Charge? No X Yes:

14. Additional description of tool.

Habitat suitability index (HSI) models use field measurements of habitat variables to compute HSI values. Models may be modified to reflect local conditions. Model output is based on a 0.0 (unsuitable habitat) to 1.0 (optimal habitat) scale. Models for warm and cold-water fishes, terrestrial mammals, and birds have been developed. The source of this information is "FORS' Directory of Forestry and Natural Resources Computer Software," 1992 Supplement.

Habitat suitability is usually computed for several components separately—forage, cover, water, reproductive habitat, etc. These models are widely used within the National Forest System, for a great diversity of indicator and special-interest species. A significant drawback of these models is that each is slightly different, and they must be run separately. Another is that they are based on cover type delineations set by the US Fish & Wildlife Service, which differ in many cases from the Forest Service cover type categories. Integration with forest vegetation simulation routines and pest models would require developing standardized crosswalk tables between the two agencies' classification systems and probably trying to collect the various HSI models into one shell to aid in efficiency. Even with these steps, the single-species by single-species approach of this kind of analysis reduces the potential significance of integration.

1. Acronym and name: ICE , Software Tools for Incremental Cumulative Effects Analysis

2. Brief Description: ICE is a collection of computer programs currently used for grizzly bear cumulative effects analysis, but it could be adapted to any species. Outputs are "habitat effectiveness" and "mortality risk index" for grizzlies.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

P Subforest

S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

P Cumulative Effects

Logging systems

Spatial

Economic/Financial

Monitoring

Transportation

Ecosystem

S Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

P Wildlife

Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

X Database Application

Spreadsheet Application

X GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

P Dynamic programming

Linear programming

Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS 5.0

Software package(s): Oracle RDBMS version 6.0;

QEMM Memory Manager, latest version.

9. Hardware requirements.

Computer: IBM or compatible microcomputer 80386SX

Graphics Card:

Math co-processor: Yes

Printer:

Disk Space:>500MB

RAM Space: 16MB

Mouse: Optional

Plotter:

Other:

10. Documentation/user support available.

X On-line help

X User's Manual

Publications

X Updates

X Training

X Telephone Support

11. Principal developer.

Collin Bevins/Systems for Environmental Management Four inter-agency modeling teams from four Western States and Canada

Other:

12. For technical information, contact:

Name: Tom Puchlerz Title: Nat'l Grizzly Bear Habitat
Coord.

Address: USDA Forest Service, Northern Region

P.O. Box 7669

Missoula, MT 59807

13. For acquisition information, contact:

Name: Same as above. Title:

Address:

Phone: (406)-329-3561 ext.
:

FAX: (406)-329-
3347

Phone: ()-

ext.:

FAX: ()-

E-mail Address: T.Puchlerz:R01A

Data General RIS file:

Acquisition Charge?

No

X

Yes:

14. Additional description of tool.

The conceptual basis for the model is described in an interagency document entitled, "CEM - A Model for Assessing Effects on Grizzly Bears," USDA Forest Service, et al., 1990. ICE is a collection of many programs that run equally well on UNIX or DOS operating systems. Data requirements are extensive, including implementation of an ORACLE relational database and spatial data housed in Arc/Info or GRASS. The purpose of the program is to assess the effects of management activities over large geographic areas (Greater Yellowstone Ecosystem, e.g.) on the habitat effectiveness and mortality risk index for grizzly bears.

The nature of the beast (wide-ranging animals that don't respect National Forest boundaries) creates obstacles to possible integration with forest vegetation and pest routines; the CEM approach is an interagency effort (Forest Service, Park Service, Fish & Wildlife Service, BLM, Idaho, Montana, Washington, and Wyoming State Fish & Game Divisions, Indian Tribes, etc.) affecting areas not modelled by the FVS. In addition, extensive data inputs are needed and many (seasonal habitats, indices of mortality risk associated with certain management actions) don't conform well to modelling efforts. This is not to suggest that the CEM and ICE are not significant tools in assessing cumulative effects on animals with large home ranges, however. It's just that the complexity of the model, and its necessary input from several different jurisdictions, make it an unlikely candidate for integration with Forest Service pest management efforts.

1. Acronym and name: OWL , Spatially-explicit simulator for Northern Spotted Owl

2. Brief Description: Allows spatial representations of spotted owl habitat, changes in that habitat, and potential impacts on spotted owls to be analyzed. Can be used for other organisms with specific life histories similar to spotted owls.

3. Geographical level of analysis (P = primary and S = secondary)

P Forestwide

S Subforest

Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

P Cumulative Effects

Logging systems

S Spatial

Economic/Financial

Monitoring

Transportation

Ecosystem

S Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

P Wildlife

Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS 2.0 or higher

Software package(s): Works best with Arc/Info or MOSS; more difficulty linking to grid systems like GRASS.

9. Hardware requirements.

Computer: 80286, 80386 with math co-processor or 80486 with Pentium

Graphics Card: VGA

Disk Space:300 KB

RAM Space: 640 KB

Math co-processor: Yes

Printer: HP Laserjet

Mouse: No

Plotter:

Other: Includes routines to dump screen to HP laser jet.

10. Documentation/user support available.

On-line help

User's Manual

X Publications

Updates

11. Principal developer.

Kevin McKelvey/USDA Forest Service/Pacific Southwest Experiment Station

Training X Telephone Support

Other:

12. For technical information, contact:

Name: Kevin McKelvey Title: Research Forester

Address: USDA Forest Service, Redwood Sciences Laboratory

1700 Bayview Drive

Arcata, CA 95521

13. For acquisition information, contact:

Name: Same as above

Title:

Address:

Phone: (707)-822-3691 ext. :

FAX: (707)-822-5628

Phone:

ext.:

FAX:

E-mail Address: K.McKelvey:S27L01A

Data General RIS file:

Acquisition Charge?

X No

Yes:

14. Additional description of tool.

OWL is an individual organism simulator model with dispersal. Users must transform GIS vegetation data into a form that the program can read. The program assists in this task, but some decisions must be made by the user. The author will assist in developing these transformations. This program has been used to evaluate potential owl habitat by the Forest Service, BLM (Oregon), and the State of Oregon.

OWL is a relatively new model and is quite specialized in terms of its usage. The process of "hand-transforming" GIS vegetation data into the OWL program's format, described by the model developer in the preceding paragraph, suggests that efforts to integrate a vegetation simulator and/or pest model would likely meet with frustration. The single-species emphasis and limited geographic applicability of the model also suggests that the potential benefits from such integration would be small compared with other possible projects.

1. Acronym and name: R2 HABCAP , Habitat Capability Model, Rocky Mountain Region

2. Brief Description: Quantifies the capability of an area to support wildlife populations based on the mix of vegetative cover types and structural stages present or predicted. 45 wildlife species and 14 vegetation cover types are included.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide P Subforest S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	S Spatial
Economic/Financial	S Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	P Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: Data General AOS/VS

Software package(s):

9. Hardware requirements.

Computer: Data General MV

Graphics Card:

Math co-processor:

Printer:

Other:

Disk Space:

RAM Space:

Mouse:

Plotter:

10. Documentation/user support available.

On-line help	X	User's Manual
Publications		Updates
X Training	X	Telephone Support

11. Principal developer.

USDA Forest Service/Rocky Mountain Region R. Holthausen/USDA Forest Service/Pacific Northwest Region

X Other: Comments in source code also

12. For technical information, contact:

Name: W.C. (Bill) Aney Title: Habitat Relationships Coord.
Address: USDA Forest Service, Black Hills National Forest

Spearfish/Nemo Ranger District, 2014 N. Main

Spearfish, SD 57783-2917

Phone: (605)-642-4622 ext.

FAX: ()

E-mail Address: W.Aney:R02F03D11A

13. For acquisition information, contact:

Name: Same as above.
Address:

Title:

Phone: ()-

ext.:

FAX: ()-

Data General RIS file :
R02A:STAFF:RWFE:6620_UPDATES:HABCAP:HABCAP.DMP
Acquisition Charge? X No Yes:

14. Additional description of tool.

HABCAP is used by some forests as the primary monitoring tool, with a decline in habitat capability used as the "trigger," which would initiate further evaluation. Typical users are forest and district biologists evaluating alternative treatments in a proposed project area, with the habitat capability values used in an environmental assessment as one element in the evaluation of alternatives. Input comes from the resource inventory data base (stage II inventories), and is in the form of acres by structural stage and vegetative cover type. For each wildlife species, each cover type/structural stage combination has a feeding value and cover value assigned to it, and the Habitat Capability value is a weighted geometric mean of these cover and feeding values. The model is not sensitive to spatial arrangement of habitat elements, and has no inherent ability to model habitat capability over time. There are at least two different versions of this model supported by the Rocky Mountain region; one for the Black Hills of South Dakota and Wyoming, and one for the remainder of the region (Wyoming and Colorado). There is also a PC version, running on QuattroPro for Windows.

In terms of potential integration with forest vegetation and pest models, a significant advantage of the HABCAP system over the HSIs for example, is HABCAP's ability to evaluate habitat for more than one species at a time. This enhances the potential value of integration. The standardization of vegetative input (Stage II inventories) also increases the ease with which integration could be achieved. While this model is specific to Region 2, very similar models are used in Regions 3 and 8 (WESTWILD and HABSIM, respectively) and parts of Regions 9 and 10 (Nicolet and Southeast Alaska HABCAP models).

As stated above, the HABCAP model has no inherent dynamic ability; linking to the FVS would allow the HABCAP models to take advantage of this feature of the FVS. In short, integration with veg. sim. and pest models has significant potential value, and could be achieved more easily than with many other wildlife habitat models. This ought to be one of the top priority integration efforts.

1. Acronym and name: RAMAS/GIS ,

2. Brief Description: Designed to link spatial habitat data in a GIS with a metapopulation model for population viability analysis and risk assessment.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

P Subforest

S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

S

Legal documentation

Resource scheduling

Cumulative Effects

Logging systems

S

Spatial

Economic/Financial

Monitoring

Transportation

Ecosystem

P

Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

P

Wildlife

Fire

Range

Vegetation

Wilderness

S

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

X

GIS Application

X

Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

Simulation

Heuristic process

Mixed-integer programming

P

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS 3.0 or higher

Software package(s): GIS data requires raster map layers in ASCII format from GRASS, IDRISI, ARC/INFO (any other, square-grid based GIS) and in binary format from IDRISI.

9. Hardware requirements.

Computer: IBM-compatible PC

Graphics Card:

Math co-processor: Recommended

Printer:

Disk Space: 2 MB

RAM Space: 580 KB

Mouse:

Plotter:

Other: EGA or VGA monitor needed. Expanded memory is highly re-commended.

10. Documentation/user support available.

On-line help

X

User's Manual

11. Principal developer.

H. Resit Akcakaya/Applied Biomathematics/Ecological research and software development

☒ Publications ☒ Updates
☒ Training ☒ Telephone Support
 Other:

12. For technical information, contact:

Name: Resit Akcakaya Title:
 Address: Applied Biomathematics

 100 North Country Road
 Setauket, NY 11733

13. For acquisition information, contact:

Name: Same as above Title:
 Address: See toll-free order number below.

Phone: (516)-751-4350 ext. : FAX: (516)-751-3435 Phone: (800)-735-4350 ext.: FAX: (516)-751-3435

E-mail Address:

Data General RIS file:
 Acquisition Charge? No X Yes:

14. Additional description of tool.

RAMAS/GIS first generates a map of habitat suitability indices (HSIs) by combining GIS maps of landscape characteristics with a habitat suitability function, both of which the user must provide. A patch recognition algorithm then identifies the structure and location of habitat patches, which are displayed overlaying the HSI map. Demographic data provided by the user is augmented with this patch data to build a spatially explicit metapopulation model (age- or stage-structured). The user then runs this metapopulation model to run ecological risk assessments, including predictions of risk of species extinction, chance of recovery, time to extinction, occupancy, abundance, etc. The geographic scale for use depends on the species of interest, but the number of rows and columns is limited such that resolution will decrease with increased scale. To date, the ability of RAMAS/GIS to perform dynamic spatial modelling is limited to comparisons between 2 or more maps.

The RAMAS family of models has received some limited use within the National Forest System, and this spatially-explicit GIS version has attracted more than its share of interest. However, the potential for integration with forest vegetation and pest models is seriously limited because of (1) RAMAS' emphasis on population dynamics data; (2) its use of HSIs (from USFWS--see discussion of integration found in HSI model description); and (3) its extensive user input requirements.

1. Acronym and name: SE ALASKA HABCAP , Habitat Capability Models for Management Indicator Species

2. Brief Description: These models access habitat and landscape attributes through a GIS, to provide estimates of habitat capability for 13 Management Indicator Species in the Tongass National Forest in southeast Alaska.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide P Subforest S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	S Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	P Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
X GIS Application	Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	S Other: GIS application

8. Supporting software requirements.

Operating system: Data General AOS/VS
Software package(s): ARC/INFO

9. Hardware requirements.

Computer: Data General
Graphics Card:

Math co-processor:
Printer:

Disk Space:
RAM Space:
Mouse:
Plotter:

Other:

10. Documentation/user support available.

On-line help	User's Manual
X Publications	Updates
Training	Telephone Support

11. Principal developer.

Lowell H. Suring/USDA Forest Service/Alaska Region Eugene J.
DeGayner/USDA Forest Service/Tongass National Forest

Other:

12. For technical information, contact:

Name: Lowell H. Suring Title:
Address: USDA Forest Service, Alaska Region

P.O. Box 21628
Juneau, AK 99801

Phone: (907)-586-7920 ext.:

FAX: (907)-586-7860

E-mail Address: L.Suring:R10A

13. For acquisition information, contact:

Name: Same as above. Title:
Address:

Phone: ()- ext.: FAX: ()-

Data General RIS file:

Acquisition Charge? X No Yes:

14. Additional description of tool.

Habitat capability models have been developed for the Vancouver Canada goose, bald eagle, hairy woodpecker, red-breasted sapsucker, brown creeper, gray wolf, black bear, brown bear, marten, river otter, Sitka black-tailed deer, mountain goat, and red squirrel. The models have been developed for application in southeast Alaska (Tongass National Forest). Habitat variables are accessed through an ARC/INFO GIS and are used to provide an estimate of habitat capability for each species. These estimates may be used to evaluate the effects of management alternatives on wildlife species.

These HABCAP models are not receiving much use currently. The modelling approach is very similar to that of the R2 HABCAP model, and the reader is directed to the discussion of veg. and pest integration potential found with the description of that model.

1. Acronym and name: WESTWILD , Region 3 Habitat Capability Model

2. Brief Description: Formerly called R03 WILD, WESTWILD measures habitat capability for 23 management indicator species, using vegetation structural stage as a variable for generating forage and cover value coefficients.

3. Geographical level of analysis (P = primary and S = secondary)
S Forestwide Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

	Budgeting		Legal documentation		Resource scheduling
S	Cumulative Effects		Logging systems		Spatial
	Economic/Financial	S	Monitoring		Transportation
	Ecosystem	P	Resource effects/Production		Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils		Water
Cultural	Minerals	Timber	P	Wildlife
Fire	Range	Vegetation		Wilderness
Fisheries	Recreation	Visual/Esthetics		
All Resources	Not Applicable	Other:		

6. Type of Tool.

Database Application		Spreadsheet Application
GIS Application	X	Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming		Network analysis
Dynamic programming	Linear programming	P	Simulation
Heuristic process	Mixed-integer programming		Statistical
Input/Output analysis	Multiobjective programming		Other:

8. Supporting software requirements.

Operating system: Data General AOS/VS
Software package(s):

9. Hardware requirements.

Computer: Data General
Graphics Card:

Math co-processor:
Printer:

Other:

Disk Space:
RAM Space:
Mouse:
Plotter:

10. Documentation/user support available.

On-line help	X	User's Manual
Publications		Updates
X	Training	Telephone Support

11. Principal developer.

Dick Holthausen/USDA Forest Service

Other:

12. For technical information, contact:

Name: Bryce Rickel Title: Habitat Coordinator
Address: USDA Forest Service, Southwestern Region

517 Gold Avenue, SW.
Albuquerque, NM 87102

Phone: (505)-842-3269 ext. FAX:

E-mail Address: B.Rickel:R03A

13. For acquisition information, contact:

Name: Same as above Title:
Address:

Phone: ext.: FAX:

Data General RIS file:
Acquisition Charge? X No Yes:

14. Additional description of tool.

WESTWILD is used to predict wildlife habitat capability to assure compliance with the Land Management Plan. Inputs include number of acres of each of 6 vegetation structural stages, by tree species. Outputs include potential number of individuals of each species supported by an area. Secondary outputs include net value of WFUD's and alpha and beta diversity indices. Spatial relationships between habitat areas are not considered.

This model is limited to Region 3 and to a couple of dozen bird and mammal species. Its veg. data are similar to the Region 2 VSS concept (structural stages). Potential integration with forest vegetation and pest models is not great, mostly because this model receives fairly limited use. However, its fundamental similarity to the R2 HABCAP model is an advantage; the reader is directed to the comments attached to the R2 HABCAP model description, where integration potential is discussed more fully.

1. Acronym and name: **BOISED** , Boise and Payette National Forest Sediment Yield Model

2. Brief Description: BOISED is the operational sediment yield model used by the Boise and Payette NFs. It is adapted from the Region 1/Region 4 sediment yield model, and estimates average annual yield increases from road construction, timber harvest, and fire.

3. Geographical level of analysis (P = primary and S = secondary)
S Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	S	Resource scheduling
S Cumulative Effects	S Logging systems		Spatial
Economic/Financial	Monitoring	S	Transportation
Ecosystem	P Resource effects/Production		Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	S	Soils	P	Water
Cultural	Minerals	S	Timber		Wildlife
S Fire	Range		Vegetation		Wilderness
S Fisheries	Recreation		Visual/Esthetics		
All Resources	Not Applicable		Other:		

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming		Network analysis
Dynamic programming	Linear programming	P	Simulation
Heuristic process	Mixed-integer programming		Statistical
Input/Output analysis	Multiobjective programming		Other:

8. Supporting software requirements.

Operating system: Data General AOS/VS
Software package(s): Personal computer version under development

9. Hardware requirements.

Computer: Data General MV series
Graphics Card:
Math co-processor:
Printer:

Disk Space:
RAM Space:
Mouse:
Plotter:

Other:

10. Documentation/user support available.

On-line help	X	User's Manual
X Publications		Updates
Training		Telephone Support

11. Principal developer.

John Potyondy and Ron Beveridge/USDA Forest Service/Boise National Forest

Other:

12. For technical information, contact:

Name: John Potyondy Title: Hydrologist
Address: USDA Forest Service, Rocky Mountain Forest &
 Range Exp't Station
 3825 E. Mulberry
 Fort Collins, CO 80524

13. For acquisition information, contact:

Name: Ron Beveridge Title: Computer Programmer Analyst
Address: USDA Forest Service, Boise National Forest
 1750 Front Street
 Boise, ID 83702

Phone: (303)-498-1846 ext. FAX: (303)-498-1660 Phone: (208)-364-4168 ext.: FAX: ()-

E-mail Address: J.Potyondy:S28A

Data General RIS file:
Acquisition Charge? X No Yes:

14. Additional description of tool.

BOISED is the operational version of the Region 1/Region 4 sediment yield model, adapted to the Boise and Payette National Forests. The procedure provides estimates of on-site erosion, delivery to stream channels, and routing of sediment downstream to critical reaches where impacts to fisheries are interpreted. The model is applied to watersheds, which are stratified using landtypes or other response units. Activities that can be modeled include road construction, reconstruction, obliteration, timber harvest, and fire. The model produces estimates of average annual sediment yields for undisturbed conditions, past activities, and activities proposed for the future. The procedure is commonly used in the preparation of EAs and EISs. Results should only be used as indicators of relative response, not absolute quantities of sediment. Model users must be well acquainted with the concepts, process, assumptions, and cautions described in the R-1/R-4 Sediment Yield Guide. Generally, the model should only be used by qualified hydrologists and soil scientists since extensive judgment is required for proper application.

The primary inputs for the R1/R4 Sediment model formulation concern the landtypes in the area of concern. These inputs include geologic and topographic data (natural sediment yield; slope shape, dissection, and roughness; etc.) which would not be accessible from any known veg. simulation model. The extent of vegetation data incorporated in models such as BOISED relates to acreage of harvested areas and method of harvest and yarding; again, not outputs that would come from something like the FVS. In short, these sediment models are driven by SOIL disturbances (road building, intense ground fires, etc.), not by changes in standing vegetation, and so their potential for integration with the veg. sim. and pest models is essentially nil.

1. Acronym and name: HYSED , R-2 Water and Sediment Yield Model

2. Brief Description: HYSED is used to estimate water and sediment yield caused by vegetation management, primarily timber harvest. The model predicts increases in sediment from in-stream sources caused by increasing streampower, but not from on-site erosion.

3. Geographical level of analysis (P = primary and S = secondary)
Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	S Soils	P Water
Cultural	Minerals	Timber	Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	S Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS 3.3 or later
Software package(s):

9. Hardware requirements.

Computer: IBM or compatible microcomputer
Graphics Card: Any

Math co-processor:
Printer:

Other:

Disk Space:147KB
RAM Space: 640KB
Mouse:
Plotter:

10. Documentation/user support available.

On-line help	X User's Manual
Publications	Updates
Training	Telephone Support

11. Principal developer.

Dave Rosgen/formerly USDA Forest Service/Arapaho National Forest Jim Weathered/formerly USDA Forest Service/Watershed Systems Development Group

- X Other: Documentation for HYSED is poor. There is a user's manual of sorts, but it is minimally useful. In the past, telephone support has been given.

12. For technical information, contact:

Name: Carl Chambers Title: Forest Hydrologist
Address: USDA Forest Service, Arapaho-Roosevelt National
 Forest
 240 West Prospect
 Fort Collins, CO 20526

13. For acquisition information, contact:

Name: Same as above. Title:
Address:

Phone: (303)-498-1093 ext. FAX: (303)-498-1010 Phone: ()- ext.: FAX: ()-

E-mail Address: C.Chambers:R02F10A

Data General RIS file:
Acquisition Charge? X No Yes:

14. Additional description of tool.

HYSED is a water-yield model based on WRENSS ("An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources"; U.S. EPA, Environmental Research Laboratory, Athens, GA 30605; 1980; Publication No. EPA-600/8-80-012), with a sediment-yield model attached. It is primarily used to predict the effects on water and sediment yield due to timber harvest. Intended users are hydrologists. Information needs are elevation, aspect, timber type, and past and planned harvest. This information can come from Rocky Mountain Region's RIS or maps and photos. The model is most applicable to the Rocky Mountain Region, and is beginning to show its age. It is not the most user-friendly model and documentation is virtually non-existent. If your interest is in predicting water yield, one of WRENSS models is recommended; either one developed by the Canadian Forestry Service, which is extremely user-friendly and provides on-line help, or the one developed by the Rocky Mountain Station, USFS, which includes the most up-to-date information from research. However, HYSED is one of the few models that predicts sediment yield from instream sources. Note: The model works best on 3rd to 4th order drainages (500 to 10,000 acres).

Potential for integration with forest vegetation and pest models is somewhat limited. The water yield component follows the basic input parameters as WRENSS and relies most heavily on basal area or leaf area index. As discussed in conjunction with the BOISED model, sediment yield modelling does not rely much on vegetative information, so integration potential for this part of HYSED would be very limited. HYSED is not very widely used, especially outside of Region 2.

1. Acronym and name: **IMPACTS** , Watershed Impact Assessment Model

2. Brief Description: A cumulative impacts model that addresses the effects of silvicultural activities on water quality and fisheries.

3. Geographical level of analysis (P = primary and S = secondary)
Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

	Budgeting	Legal documentation	Resource scheduling
P	Cumulative Effects	Logging systems	Spatial
	Economic/Financial	Monitoring	Transportation
	Ecosystem	S Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

	Air	Insect/Disease	S Soils	P Water
	Cultural	Minerals	Timber	Wildlife
	Fire	Range	Vegetation	Wilderness
S	Fisheries	Recreation	Visual/Esthetics	
	All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	X	Spreadsheet Application
GIS Application	X	Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS 2.1 or later; Data General AOS/VS
Software package(s): Executable pc program; Basic DG version

9. Hardware requirements.

Computer: IBM or compatible microcomputer 8086 or above; Data General
Graphics Card:
Math co-processor:
Printer:

Disk Space:
RAM Space: 640KB
Mouse:
Plotter:

Other:

10. Documentation/user support available.

On-line help	X	User's Manual
X Publications		Updates
Training		Telephone Support

11. Principal developer.

J. Alan Clingenpeel/USDA Forest Service/Quachita National Forest

Other:

12. For technical information, contact:

Name: J. Alan Clingenpeel Title: Forest Hydrologist
Address: USDA Forest Service, Ouachita National Forest

P.O. Box 1270
Hot Springs, AR 71902

13. For acquisition information, contact:

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Address:

Phone: (501)-321-5246 ext. FAX: (501)-321-5334 Phone: ()- ext.: FAX: ()-

E-mail Address: J.Clingenpeel:R08F09A

Data General RIS file:
Acquisition Charge? X No Yes:

14. Additional description of tool.

IMPACTS is the primary sediment modelling tool used in Region 8. It uses predicted sediment yields as the surrogate for determining cumulative impacts for water quality.

It has little potential for integration with forest vegetation simulation and pest models for the reasons outlined in the description of the BOISED sediment model.

1. Acronym and name: NEZSED , Nez Perce National Forest Sediment Yield Model

2. Brief Description: Adapted from the R1R4 Sediment Yield Guidelines, NEZSED predicts the effects of forest management activities (logging, roads, fire) on sediment yield.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	S Soils	P Water
Cultural	Minerals	Timber	Wildlife
Fire	Range	Vegetation	Wilderness
S Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: Data General AOS/VS
Software package(s): Oracle Database

9. Hardware requirements.

Computer: Data General MV
Graphics Card:

Math co-processor:
Printer:

Other:

Disk Space:
RAM Space:
Mouse:
Plotter:

10. Documentation/user support available.

On-line help	X	User's Manual
X Publications		Updates
Training	X	Telephone Support

11. Principal developer.

Joy Harmon and Nick Gerhardt/USDA Forest Service, Nez Perce National Forest

Other:

12. For technical information, contact:

Name: Nick Gerhardt Title: Forest Hydrologist
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Rt. 2, Box 475
Grangeville, ID 83530

13. For acquisition information, contact:

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Address:

Phone: (208)-983-1950 ext.
:

FAX: (208)-983-
1553

Phone: ext.: FAX:

E-mail Address: N.Gerhardt:R01F17A

Data General RIS file:

Acquisition Charge? X No Yes:

14. Additional description of tool.

NEZSED is a local adaptation of the R1R4 Sediment Yield Guidelines (Cline, et al, 1981, Guide for Predicting Sediment Yields from Forested Watersheds, USDA Forest Service, Northern Region and Intermountain Region). The model accounts for surface erosion and small mass failures, but does not, at present, predict effects of management on channel erosion or large mass failures. NEZSED can be used in conjunction with FISHSED to predict effects of increased sediment yield on fish habitat. The model resides on the DG at the Nez Perce Forest Supervisor's Office and at the Forest's six districts. Watershed and activity data are found in an ORACLE database at the Forest Supervisor's Office. Inputs include road density, road acres, harvest acres, and fire acres. Other inputs, including land type and geological coefficient, are obtained from the central database. Outputs include annual sediment yield in tons/sq. mile over a 10-year period and a routing coefficient based on the number of square miles considered. These values are computed for prescription watersheds which in many cases are not true watersheds; this discrepancy may reduce the utility of the yield and routing outputs in these cases and require further analysis by the user.

Potential for integration with forest vegetation simulation and pest models is not great for the reasons discussed in the description of the BOISED model, which is, like NEZSED, a local adaptation of the R1/R4 Sediment Model. The reader is directed to the BOISED model for more information.

1. Acronym and name: SEDROUTE ,

2. Brief Description: SEDROUTE assesses changes to erosion, sediment yields, and water yield from proposed projects.

3. Geographical level of analysis (P = primary and S = secondary)
Forestwide P Subforest S Project

4. Purpose of analysis (P = primary and S = secondary)

	Budgeting	Legal documentation	Resource scheduling
S	Cumulative Effects	Logging systems	Spatial
	Economic/Financial	Monitoring	Transportation
	Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

	Air	Insect/Disease	S Soils	P Water
	Cultural	Minerals	Timber	Wildlife
	Fire	Range	Vegetation	Wilderness
S	Fisheries	Recreation	Visual/Esthetics	
	All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: Data General AOS/VS
Software package(s):

9. Hardware requirements.

Computer: Data General
Graphics Card:

Math co-processor:
Printer: Wide carriage

Disk Space:
RAM Space:
Mouse:
Plotter:

Other: Output is usually printed on a wide printer, but can be sent to a file and printouts edited, so it will print on landscape 15 pitch.

10. Documentation/user support available.

On-line help	X	User's Manual
X Publications		Updates
Training	X	Telephone Support

11. Principal developer.

Dennis Kelly/USDA Forest Service/Manti-La Sal National Forest

Other:

12. For technical information, contact:

Name: Dennis Kelly Title: Hydrologist

Address: USDA Forest Service, Manti-La Sal National Forest Address:

599 West Price River Drive

Price, UT 84501

13. For acquisition information, contact:

Name: Same as above.

Title:

Phone: (801)-637-2817 ext.

FAX: (801)-637-4940

Phone: ()-

ext.:

FAX: ()-

E-mail Address: D.Kelly:R04F10A

Data General RIS file:

Acquisition Charge?

X No

Yes:

14. Additional description of tool.

The model collects erosion products from map units in a watershed, routes these products to up to four points downstream, and presents totals and summaries of erosion, sediment, and water yields. SEDROUTE should be used by someone knowledgeable about erosion, sediment yields, and water yields. Inputs include map unit acreage, runoff curve numbers, erosion rates (inches/year), Pollution Hazard Index, water yield rate (inches/year), sediment routing table, and future conditions of the map units. Outputs are: tabulations of erosion, sediment yields, and water yields by map units within watersheds, with tabulations showing changes in above, from projects. Summaries show changes in erosion and sediment yields and water quality. Impacts of future projects are routed downstream to up to four points. SEDROUTE is limited, in that results are "ball-park" data; erosion and sediment yields are impossible to predict with accuracy, and it takes a lot of work to assemble the data to run this program. There are several untested assumptions about transportation of erosion products to stream channels. This program is currently being rewritten for the Data General. It was on the USDA Unisys computer in Fort Collins, CO.

As a primarily sediment-oriented model, SEDROUTE's potential for integration with forest vegetation simulation and pest models is limited. Most erosion on forested watersheds has little to do with the type or amount of vegetation present and relates instead to soil disturbances. The reader is directed to the comments found in the description of the BOISED sediment model for a fuller discussion of the limits to sediment-vegetation model integration.

1. Acronym and name: **SHADOW** , Stream Temperature Management Program

2. Brief Description: SHADOW is a spreadsheet program allowing the user to estimate the amount of unshaded stream and maximum stream temperature for either an individual stream reach or a basin.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide

Subforest

P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

S Cumulative Effects

Logging systems

Spatial

Economic/Financial

Monitoring

Transportation

Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

S Water

Cultural

Minerals

Timber

Wildlife

Fire

Range

Vegetation

Wilderness

P Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

X Spreadsheet Application

GIS Application

Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

9. Hardware requirements.

Operating system: DOS or other non-windows system

Computer:

Software package(s): LOTUS 123, vsn 2.01 or greater

Graphics Card:

Math co-processor:

Printer:

Other:

Disk Space:

RAM Space:

Mouse:

Plotter:

10. Documentation/user support available.

On-line help

X

User's Manual

Publications

Updates

Training

X

Telephone Support

11. Principal developer.

Chris Park, Siskiyou National Forest, Gold Beach District,

Other:

12. For technical information, contact:

Name: Chris Park Title:
Address: Siskiyou National Forest, Gold Beach Ranger District,
Gold Beach, OR 97444

13. For acquisition information, contact:

Name: Bruce McCammon Title: Regional Hydrologist
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333 S.W. First Ave., P.O. Box 3623
Portland, OR 97208

Phone: 503-247-6651 ext.:

FAX:

Phone: 503-326-3360 ext.:

FAX:

E-mail Address:

Data General RIS file:

Acquisition Charge? X No Yes:

14. Additional description of tool.

SHADOW contains 3 sub-routines: (1) a solar model that calculates the sun's zenith and azimuth angles given latitude and declination; (2) a shade model that calculates the amount of unshaded stream and riparian width given channel, terrain, and vegetation characteristics in conjunction with the solar angles; (3) a stream temperature model that calculates 5-day average maximum summer stream temperature. By simulating changes in stream shade resulting from different management prescriptions, SHADOW allows the user to assess cumulative effects of several activities on stream temperature, estimate future stream temperature recovery rates, design riparian timber harvest prescriptions, and assess riparian enhancement opportunities. SHADOW has been incorporated into SNAP (Scheduling and Network Analysis Program).

SHADOW is in use in Oregon, Idaho, Washington, and California. The vegetation characteristics it employs include percent tree overhang, tree height, shade density, and tree-channel distance (from channel to base of vegetation forming the riparian canopy). Vegetation data are estimated with the use of aerial photos and silvicultural information rather than with simulation. Pest impacts would likely affect all of these vegetation interactions, either through direct mortality or through defoliation and reduction in shade density. Integration of SHADOW with forest vegetation and pest models has significant potential benefits in terms of relating future conditions to stream temperature.

1. Acronym and name: WATBAL ,

2. Brief Description: WATBAL is a cumulative effects sediment model, the primary purpose of which is to define slope stability in the perspective of the watershed.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

P Subforest

S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

P Cumulative Effects

Logging systems

Spatial

Economic/Financial

S

Monitoring

Transportation

Ecosystem

S

Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

S

Soils

P

Water

Cultural

Minerals

Timber

Wildlife

Fire

Range

S

Vegetation

Wilderness

Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X

Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P

Simulation

Heuristic process

Mixed-integer programming

S

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: Data General AOS/VS

Software package(s):

9. Hardware requirements.

Computer: Data General

Graphics Card:

Math co-processor:

Printer:

Other:

Disk Space:

RAM Space:

Mouse:

Plotter:

10. Documentation/user support available.

On-line help

X

User's Manual

Publications

X

Updates

X

Training

Telephone Support

11. Principal developer.

R. Patten/USDA Forest Service/Wasatch-Cache National Forest

Other:

12. For technical information, contact:

Name: G. Howard Title: Hydrologist Technician
Address: USDA Forest Service, Clearwater National Forest

12730 Highway 12
Orofino, ID 83544

13. For acquisition information, contact:

Name: Same as above. Title:
Address:

Phone: (208)-476-4541 ext. FAX: (208)-476-0129 Phone: ()- ext.: FAX: ()-

E-mail Address: G.Howard:R01F05A

Data General RIS file:
Acquisition Charge? X No Yes:

14. Additional description of tool.

WATBAL is linked to FISHSED to define Forest Plan standards and guidelines. It quantifies and delivers both natural and accelerated sediment, and relates it to a geomorphic threshold developed for that watershed.

Potential for integration with forest vegetation and pest models is limited for several reasons: (1) WATBAL is not particularly widely used within the Forest Service, and its use is limited to the Intermountain Region; (2) sediment models in general are not good candidates for veg. and pest integration because veg. and pest simulations are largely irrelevant to the primary inputs of sediment models, which are geologic, topographic, and soil disturbance-oriented activities. For a more detailed discussion of (2), the reader is directed to the description associated with the BOISED sediment model.

1. Acronym and name: WATSED , Water and Sediment Yields

2. Brief Description: WATSED is a water and sediment yield model that can be locally calibrated to reflect the effects from specific management activities on water and sediment.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide

S Subforest

P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

S Cumulative Effects

Logging systems

Spatial

Economic/Financial

Monitoring

S Transportation

Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

S

Soils

P

Water

Cultural

S

Minerals

S

Timber

Wildlife

S Fire

S

Range

Vegetation

Wilderness

S Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X

Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P

Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS

Software package(s): dBase IV is preferred

9. Hardware requirements.

Computer: IBM or compatible microcomputer 80286 or above

Graphics Card:

Disk Space:2MB

RAM Space: 1MB

Math co-processor: Recommended

Mouse:

Printer:

Plotter:

Other:

10. Documentation/user support available.

On-line help

X

User's Manual

Publications

Updates

Training

Telephone Support

11. Principal developer.

Rosa Nygaard and Bill Putnam/USDA Forest Service/Northern Region

Other:

12. For technical information, contact:

Name: Rosa Nygaard Title: Programmer-Analyst
Address: USDA Forest Service, Northern Region

P.O. Box 7669
Missoula, MT 59807

13. For acquisition information, contact:

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Address:

Phone: (406)-329-3461 ext. FAX: (406)-329-3132 Phone: ()- ext.: FAX: ()-

E-mail Address: R.Nygaard:R01A

D a t a G e n e r a l R I S f i l e :
R01C:PUBLIC:APPLICATIONS_LIBRARY:2500_LIBRARY:
R1WATSED_PROGRAMS.02.01.DMP and :R1WATSED_DATA.02.01.
Acquisition Charge? X No Yes:

14. Additional description of tool.

WATSED is being used by the forests in the Northern Region and by cooperators in the Montana Cumulative Watershed Effects Cooperative to assess the effects on water yield and sediment production from ground disturbing activities. The model predicts changes to water yield and sediment from roads, fire, logging, and site preparation activities. Locally derived effects from grazing and mining impacts can be added. Eleven external files are required to run the model. The files are structured as independent databases that once established can be modified without affecting the model. A Land System Inventory (LSI) file is required to provide basic land-type data for the watershed being modeled. An Activities file requires a history of past ground-disturbing activities and any proposed activities. The model can be run to indicate current conditions and analyze effects of project alternatives.

The sediment modelling portion of WATSED is based on the R1/R4 Sediment Model. The potential for integration of this sort of sediment modelling with veg. sim. and pest models is very limited; a discussion of these limitations can be found in the description of the BOISED model. The water yield component of WATSED might have more to gain from integration, however its application is limited to Region 1. Likewise, it is doubtful that much benefit would be gained from linking this model to the pest model extensions.

1. Acronym and name: **WEPP** , Water Erosion Prediction Project

2. Brief Description: WEPP is a distributed parameter, continuous simulation, erosion prediction model, implemented as a set of computer programs for PCs.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide S Subforest P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
S Cumulative Effects	Logging systems	S Spatial
Economic/Financial	S Monitoring	Transportation
S Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	P Soils	S Water
Cultural	Minerals	Timber	Wildlife
Fire	S Range	S Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS version 5.0 or later
Software package(s): Text Editor (DOS Edit works well)

9. Hardware requirements.

Computer: IBM-compatible PC, 80386 with math co-processor.
Graphics Card:
Math co-processor: Needed
Printer:
Disk Space: 10 MB
RAM Space: 1 MB
Mouse: No
Plotter:

Other: May be able to compile with some UNIX systems.

10. Documentation/user support available.

On-line help	X	User's Manual
X Publications		Updates
X Training		Telephone Support

11. Principal developer.

John Laflen/National Soil Erosion Lab @ Purdue University/Bill Elliot, Charlie Luce, Pete Robichaud, Randy Foltz/Engineering Technology, USDA Forest Service, Intermountain Research Station.

Other: R6, R2, R1, R4 have training sessions scheduled.

12. For technical information, contact:

Name: Bill Elliot Title: Project Leader
Address: USDA Forest Service, Intermountain Research Station, Forestry Sciences Lab
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Moscow, ID 83843

13. For acquisition information, contact:

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Address:

Phone: (208)-883-2338 ext.

FAX: (208)-883-2318

Phone: ext.:

FAX:

E-mail Address: W.Elliot:S22L04A

Data General RIS file: Contact P.Swetik:S22L04A

Acquisition Charge? X No Yes:

14. Additional description of tool.

Many of WEPP's current predictive capabilities may be more suited to rangeland and agricultural applications than to forest management. Several versions of WEPP are or will be available to address such diverse issues as irrigation simulation and watershed analysis. Four major classes of input data are required: climate, slope, soil, and management. WEPP's file builders assist the user in easily generating the slope and soil input files, and the CLIGEN program facilitates creation of a climate file. The management input file is the most complex and requires the largest number of parameters, which vary widely from application to application. Output generated by WEPP includes estimates of average annual soil loss from or deposition to 100+ points on a hillslope, sediment delivery from the hillslope to neighboring waterways, single-storm simulations of runoff and erosion, and detailed files on the various components that contribute to water balance. One such component is accumulation of plant biomass, and work is underway by the USDA Forest Service to incorporate plant growth routines applicable to forested conditions. (These regeneration routines are similar to a process-based regeneration model being developed to complement PROGNOSIS. It should be available for distribution with the WEPP model by January, 1996. Until then, the rangeland plant growth model incorporates senescence of canopy, litter accumulation and decomposition, and soil water balances for a mixture of grass, trees, and shrubs.) Other conceptual components include winter processes (snowdrifting and melting) and effects of tillage, soil roughness, and living plant cover on runoff rates. The erosion predictions from WEPP are meant to be applicable to "field-sized" areas (about 50 acres) of analysis. The watershed version, a research copy of which will be available in Spring, 1995, will be better suited to analyzing harvest units with multiple hillslopes and channels. In its current form, WEPP is performing well in predicting sediment from forest roads.

1. Acronym and name: WOODY DEBRIS MODEL ,

2. Brief Description: This model estimates natural rates of input of large woody debris to stream channels, based on stand density and maturity, and on tree-fall probabilities.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

P Subforest

S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

S Cumulative Effects

Logging systems

S Spatial

Economic/Financial

Monitoring

Transportation

S Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

P Water

Cultural

Minerals

S Timber

Wildlife

Fire

Range

Vegetation

Wilderness

S Fisheries

Recreation

Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

S Simulation

Heuristic process

Mixed-integer programming

P Statistical

Input/Output analysis

Multiobjective programming

S Other: Geometry; difference equations

8. Supporting software requirements.

Operating system: DOS

Software package(s):

9. Hardware requirements.

Computer: IBM or compatible microcomputer

Graphics Card:

Math co-processor:

Printer:

Other:

Disk Space:

RAM Space:

Mouse:

Plotter:

10. Documentation/user support available.

On-line help

User's Manual

Publications

Updates

Training

Telephone Support

11. Principal developer.

John VanSickle/Statistical and Modeling Consultant Stan Gregory/Oregon State University/Dept. of Fisheries and Wildlife

Other:

12. For technical information, contact:

Name: John VanSickle Title: Statistician

Address: 1898 NW. Forest Green

Corvallis, OR 97330

e: (503)-753-5831 ext. FAX: ()-

eral address:

Phone: ext. FAX:

E-mail Address:

13. For acquisition information, contact:

Name: Title:

Address:

Phone: ext.: FAX:

Data General RIS file:

Acquisition Charge? No Yes:

14. Additional description of tool.

Inputs include: riparian stand density and height distribution; tree-fall probability distributions, classified by height and species classes; regeneration rates; and riparian zone geometry. Outputs are time trajectories of probabilistic woody debris loading rates for stream channels.

As of 1995, interest in the WOODY DEBRIS MODEL was mostly scientific; it does not appear to be widely used within the National Forest System. However, the increased attention paid to the effects of woody debris, whether associated with streams (and fish habitat) or with mature forests (and certain wildlife habitat), suggests that there would be some benefit to investigating the possibility of linking this model with the FVS. At the very least, the FVS could be enhanced by integrating some of the probability distribution modelling of the WOODY DEBRIS MODEL into its own debris-generation routines. It would be most interesting to compare the outputs of this model with the Snag Recruitment Simulator for a particular stand (real or hypothetical).

1. Acronym and name: WRNSHYD , Hydrological Portion of U.S. EPA WRENNSS Manual

2. Brief Description: WRNSHYD is the water-yield component of the larger system model from "Water Resources Evaluation Nonpoint Sources Silviculture" (WRENNSS). It is an interactive program to estimate effects of existing or proposed silvicultural activities (including harvest) on annual water yield.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide P Subforest S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
P Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	S Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	P Water
Cultural	Minerals	Timber	Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	P Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	Other:

8. Supporting software requirements.

Operating system: DOS 2.0 or later
Software package(s):

9. Hardware requirements.

Computer: IBM or compatible microcomputer
Graphics Card:

Math co-processor:
Printer: Optional

Other:

Disk Space:700KB
RAM Space: 256KB
Mouse:
Plotter:

10. Documentation/user support available.

X On-line help	User's Manual
Publications	X Updates
X Training	X Telephone Support

11. Principal developer.

Robert H. Swanson/R.H. Swanson & Associates

Other:

12. For technical information, contact:

Name: Robert H. Swanson Title: Principal Forest Hydrolog.
Address: R.H. Swanson & Associates

Box 1431

Canmore, Alberta Canada T0L 0M0

13. For acquisition information, contact:

Name: Same as above. Title:
Address:

Phone: (403)-678-6096 ext.

FAX: ()-

Phone: ()-

ext.:

FAX: ()-

E-mail Address:

Data General RIS file:

Acquisition Charge?

No

X

Yes: Cost of disk, mailer, and postage

14. Additional description of tool.

WRNSHYD is an interactive program to estimate effects of planned or existing forest harvests on annual water yield. The program is a full implementation of the graphical procedure given in the U.S. EPA WRENS handbooks. Some modifications have been included to supplement the graphical procedure: i.e., user input of wind speed as it affects snow transport and sublimation; automatic calculation of regeneration height as a function of basal-area increase after harvest; and added curves for deciduous trees in all WRENS regions. All of these modifications can be switched off to restore original WRENS results. It is limited to the United States and Canada (excluding Hawaii). Cumulative effects can be obtained. A version to operate directly on dBase files is in development.

The primary vegetative input to WRNSHYD is basal area, which is easily accessed from forest vegetation simulation models, suggesting that integration would be relatively easy here. Some parts of the country (particularly rain-dominated areas) use Leaf Area Index instead of basal area as the chief veg. input in terms of water yield. Generating LAI from veg. simulation models would be more difficult, but not impossible. While these inputs to WRNSHYD are usually evaluated with respect to timber harvests, the effects on annual water yield of pest-induced mortality (and/or defoliation) and of projected future growth would be significant. Compared to sediment modelling then, the potential for integration of veg. and pest models with water yield models is definitely greater.

1. Acronym and name: INFRASTRUCTURE ,

2. Brief Description: INFRASTRUCTURE is an integrated recreation management application with modules to support travel routes, land units (recreation sites, management areas, etc.), facilities, and utilities.

3. Geographical level of analysis (P = primary and S = secondary)

P Forestwide S Subforest S Project

4. Purpose of analysis (P = primary and S = secondary)

S	Budgeting	Legal documentation	Resource scheduling
S	Cumulative Effects	Logging systems	Spatial
	Economic/Financial	S Monitoring	Transportation
	Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

	Air	Insect/Disease	Soils	Water
S	Cultural	Minerals	Timber	Wildlife
	Fire	Range	Vegetation	S Wilderness
	Fisheries	P Recreation	S Visual/Esthetics	
	All Resources	Not Applicable	Other:	

6. Type of Tool.

X	Database Application	Spreadsheet Application
X	GIS Application	Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	P Other: Database application

8. Supporting software requirements.

Operating system: Data General AOS/VS
Software package(s): Oracle

9. Hardware requirements.

Computer: Data General
Graphics Card:

Math co-processor:
Printer:

Other:

Disk Space:
RAM Space:
Mouse:
Plotter:

10. Documentation/user support available.

X	On-line help	X	User's Manual
X	Publications	X	Updates
X	Training	X	Telephone Support

11. Principal developer.

USDA Forest Service/Washington Office

Other:

12. For technical information, contact:

Name: Tah Yang Title: Computer Systems
Address: USDA Forest Service, Washington Office

4th Floor Central, P.O. Box 96090

Washington, DC 20090

13. For acquisition information, contact:

Name: Same as above. Title:
Address:

Phone: (202)-205-1409 ext.

FAX: (202)-205-1145

Phone: ext.:

FAX:

E-mail Address: T.Yang:W01C

Data General RIS file:

Acquisition Charge? X No Yes:

14. Additional description of tool.

INFRASTRUCTURE incorporates components of several databases and systems no longer in use, including the Recreation Resource Information System (RRIS), the Asset Management System (AMS), and the Contact Management System (CMS). It also allows management of recreation using the Recreation Opportunity Spectrum (ROS). It is anticipated that INFRASTRUCTURE's Oracle Relational Database setup will allow links with forest vegetation inventory data and with the Project 615 GIS system.

Potential links with dynamic forest vegetation simulations (and with pest models) are significant, although the specific implementation of such links is unclear at this time because of the newness of Infrastructure, the delays in the Project 615, and the need for managers to become familiar with both before trying to add the dynamic element. Like the new Scenery Management System, INFRASTRUCTURE is more integrated and more complex than any of its predecessors, so it remains to be seen how it will be used on the ground.

1. Acronym and name: NEWPER , PC New Perspectives

2. Brief Description: NEWPER is a package for perspective graphic modeling of management activities involving terrain, forest cover, structures, and linear features.

3. Geographical level of analysis (P = primary and S = secondary)

S Forestwide

S Subforest

P Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting

Legal documentation

Resource scheduling

S Cumulative Effects

S Logging systems

Spatial

Economic/Financial

Monitoring

Transportation

Ecosystem

P Resource effects/Production

Other:

5. Resource or function (P = primary and S = secondary)

Air

Insect/Disease

Soils

Water

Cultural

Minerals

Timber

Wildlife

Fire

Range

Vegetation

Wilderness

Fisheries

Recreation

P Visual/Esthetics

All Resources

Not Applicable

Other:

6. Type of Tool.

Database Application

Spreadsheet Application

GIS Application

X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems

Integer programming

Network analysis

Dynamic programming

Linear programming

P Simulation

Heuristic process

Mixed-integer programming

Statistical

Input/Output analysis

Multiobjective programming

Other:

8. Supporting software requirements.

Operating system: DOS 3.0 or later

Software package(s):

9. Hardware requirements.

Computer: IBM or compatible microcomputer 80286, 80386, or 80486

Graphics Card: EGA or VGA

Disk Space: 5MB +/-

RAM Space: low 640KB

Math co-processor: Optional

Mouse:

Printer: Optional-any do

Plotter: HP/Calcomp/H

Other: Digitizer - wide range of 12 button and 16 button models. Demonstration diskette available.

10. Documentation/user support available.

On-line help

X

User's Manual

X Publications

X

Updates

X Training

X

Telephone Support

11. Principal developer.

Devon Nickerson/Visual Simulations, Inc.

Other:

12. For technical information, contact:

Name: Devon Nickerson Title:
Address: 1330 Fir Street South

Salem, OR 97302

13. For acquisition information, contact:

Name: Same as above. Title:
Address:

Phone: (503)-391-6995 ext. :

FAX:

Phone: ()-

ext.:

FAX: ()-

E-mail Address:

Data General RIS file:

Acquisition Charge? No X Yes:

14. Additional description of tool.

NEWPER links with: VISQUAL (another Nickerson product), Auto CAD, USGS DEM database, True Vision, any desktop publishing package, any paintbrush package, and advanced hardcopy output drivers (laser, thermal wax, inkjet, electrostatic). The model may be somewhat outdated in comparison with other visual simulation efforts, especially since the developer is not currently active in developing upgrades, etc. Still, this is the simulation model most cited by landscape architects in the scenery management and recreation model DG survey completed Summer, 1994.

The pest implications to this kind of modelling are great, and the FPM-MAG group is exploring them through INFORMS. The potential for integration is poor here, though, because the NEWPER model is very project-oriented (site-specific) and because it is not exactly at the cutting edge anymore.

1. Acronym and name: SMS , Scenery Management System

2. Brief Description: Provides a framework for the systematic inventory, analysis, and management of scenery.

3. Geographical level of analysis (P = primary and S = secondary)

P Forestwide S Subforest Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
Cumulative Effects	Logging systems	S Spatial
Economic/Financial	S Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
S Cultural	Minerals	Timber	Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	S Recreation	P Visual/Esthetics	
All Resources	Not Applicable	Other:	

6. Type of Tool.

X Database Application	Spreadsheet Application
X GIS Application	Computer program

7. Modeling techniques (P = primary and S = secondary)

S AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	P Other: Database applications (queries)

8. Supporting software requirements.

Operating system: UNIX
Software package(s): Arc/Info with ArcView 2

9. Hardware requirements.

Computer: Work Station or PC
Graphics Card:

Math co-processor:
Printer:

Other:

Disk Space:
RAM Space:
Mouse:
Plotter:

10. Documentation/user support available.

On-line help	X User's Manual
X Publications	Updates
X Training	Telephone Support

11. Principal developer.

USDA Forest Service, Washington Office, Pacific Northwest Regional Office,
Southern Regional Office

Other:

12. For technical information, contact:

Name: Mike Miller Title: Landscape Architect
Address: USDA Forest Service
 Kisatchie National Forest
 2500 Shreveport Hwy.
 P.O. Box 5500
 Pineville, LA 71361-5500

13. For acquisition information, contact:

Name: Larry Blocker Title: Recreation
Address: USDA Forest Service
 Northern Region
 Federal Bldg.
 P.O. Box 7669
 Missoula, MT 59807

Phone: 318-473-7146 ext.:

FAX:

Phone: 406-329-3576

ext.:

FAX: 406-329-3132

E-mail Address: M. Miller:R08F06A

Data General RIS file:

Acquisition Charge?

No

Yes:

14. Additional description of tool.

The Scenery Management System is the Forest Service's new system to help forest managers address scenic quality in their plans and implementations. The SMS replaces the old Visual Resource Management system. As of Spring 1995, it had been successfully tested in several sites, and training sessions had been given in several regional offices.

The model is GIS-based, and begins with landscape units or landtype associations as fairly homogeneous areas of scenic character. Pursuant to evaluating these land units, the existing scenic condition is determined, based on the magnitude of human-caused deviation from the natural form, line, color, and texture of the landscape. Landscape visibility is the third component, taking into consideration viewsheds, distance zones, travelways, and use areas.

The potential for integration with forest vegetation and pest models is significant; however, because the model is not fully operational nationwide (and because, as of this writing, a user's guide was still unavailable), it remains to be seen exactly how the links between vegetation simulation and the SMS might be developed.

1. Acronym and name: VISQUAL , Visual Quality

2. Brief Description: VISQUAL is a GIS-like approach to quantitative elements of the scenic resource, allowing large area evaluation simultaneously from many viewpoints.

3. Geographical level of analysis (P = primary and S = secondary)

Forestwide P Subforest S Project

4. Purpose of analysis (P = primary and S = secondary)

Budgeting	Legal documentation	Resource scheduling
Cumulative Effects	Logging systems	Spatial
Economic/Financial	Monitoring	Transportation
Ecosystem	P Resource effects/Production	Other:

5. Resource or function (P = primary and S = secondary)

Air	Insect/Disease	Soils	Water
Cultural	Minerals	Timber	Wildlife
Fire	Range	Vegetation	Wilderness
Fisheries	Recreation	P Visual/Esthetics	
S All Resources	Not Applicable	Other:	

6. Type of Tool.

Database Application	Spreadsheet Application
GIS Application	X Computer program

7. Modeling techniques (P = primary and S = secondary)

AI/Expert systems	Integer programming	Network analysis
Dynamic programming	Linear programming	S Simulation
Heuristic process	Mixed-integer programming	Statistical
Input/Output analysis	Multiobjective programming	P Other: Combinatorial logic

8. Supporting software requirements.

Operating system: DOS 3.0 or later
Software package(s):

9. Hardware requirements.

Computer: IBM or compatible microcomputer 80286, 80386, or 80486
Graphics Card: EGA or VGA
Disk Space: 3MB +/-
RAM Space: low 640KB
Mouse:
Plotter: HP/CalComp/H

Other: Digitizer - wide range of 12-button and 16-button models.

10. Documentation/user support available.

On-line help	X	User's Manual
X Publications	X	Updates
X Training	X	Telephone Support

11. Principal developer.

Devon Nickerson/Visual Simulations, Inc.

X Other: Demonstration diskette available.

12. For technical information, contact:

Name: Devon Nickerson Title:
Address:

1330 Fir Street South
Salem, OR 97302

Phone: (503)-391-6995 ext.

FAX:

E-mail Address:

13. For acquisition information, contact:

Name: Same as above. Title:
Address:

Phone: ()-

ext.:

FAX: ()-

Data General RIS file:

Acquisition Charge?

No

X

Yes:

14. Additional description of tool.

VISQUAL links with: NEWPER (PC NewPerspectives, another Nickerson product), USGS DEM database, Arc/Info, any desktop publishing package, any paintbrush package, and advanced hardcopy output drivers (laser, thermal wax, inkjet, and electrostatic). It also allows emulations of the old Visual Resource Management system (now the Scenery Management System).

Like NEWPER, VISQUAL is a bit outdated. The developer is no longer actively involved in producing updates to VISQUAL, and it is likely that other programs have surpassed it in many ways. Also, the changes in the way the Forest Service manages the scenic resource, embodied in the new SMS, may make some of the VISQUAL runs obsolete.

The implications of this kind of model to pest management are significant; they depend, however, on technology that is still very much in the development process (some of it happening within pest management itself—see INFORMS). In terms of integration with vegetation simulation models, it seems best to take a wait-and-see approach until the results of Lyle Gomm's visual simulation task force study are released later this summer.

Appendix B: Tables Comparing Models of Similar Function

Fire and Fuels Models

Model Name	Applications	Geographic Area of Use	Hardware & Software Systems	Outputs	Vegetation Inputs
WIMS (Weather Information Management System)	Fire weather and history information storage and management	Nationwide	IBM/MVS; Oracle software required	Weather forecasts; historic fire weather and occurrence data	None
NFDRS (National Fire Danger Rating System)	Generates large-scale fire danger indices	Nationwide	PC (DOS) or through WIMS	Index of fire danger	Fuel models A through U
FIREFAMILY	Statistical analysis of historic fire weather	Nationwide	MVS; DOS versions available	Statistics to aid in fire management; calibration of NFDRS	None
CFFDRS (Canadian Forest Fire Danger Rating System)	Determines fire danger and predicts fire behavior	Canada, Alaska, Northern Rocky Mountains and Great Lakes	DOS for IBM-compatible PC; self-contained computer program	Fire danger (ease of ignition) and behavior (rate of spread, intensity, consumption)	Qualitative Canadian Fuel Models (1-16)
RERAP (Rare Event Risk Assessment Process)	Calculates risk of fire spread, significant smoke, and fire-ending weather	No geographic restrictions	DOS for PC; Windows version scheduled; QuattroPro required	Probability distributions and frequencies for fire-ending, spread, and smoke events	FBO fuel models as used in BEHAVE
BEHAVE (Fire Behavior Prediction and Fuel Modeling System)	Predicts fire behavior and aids in prescribed fire planning	Nationwide	DOS or Data General AOS/VS	Rate of spread, intensity, flame length, spotting distance, scorch height	13 Fire Behavior Officer (FBO) fuel models; fuel loading and depth by diameter class
DEBMOD (Debris Prediction System)	Assesses potential debris from harvest or thin	No geographic restrictions	DOS and Data General AOS/VS; program is self-contained	Debris by fuel diameter class in tons/acre, segregated by species and DBH class	From stand exam or timber cruise: stand and individual tree data (species, DBH, etc.)
DFINV (Down Fuel Inventory System)	Inventories dead and downed woody material	No geographic restrictions	DOS and Data General AOS/VS; program is self-contained.	Weight, volume, and depth of fuels, using planar intersect technique	Specific tree data for individual plots
CONSUME	Estimates fuel consumption for prescribed burns	Suited best for Pacific Northwest ecosystems	DOS; program is self-contained	Consumption of fuels by date and moisture	Fuel loading by diameter class, moisture content of fine fuels
SASEM (Simple Approach Smoke Estimation Model)	Screens for air quality impacts from proposed prescribed burns	No geographic restrictions	DOS; program is self-contained	Maximum particulate concentration; minimum visual range estimates	Fuel type and loading by diameter class
FOFEM (First Order Fire Effects Model)	Predicts fire effects on ecosystem components	Nationwide	DOS; program is self-contained	Fuel consumption, tree mortality, smoke production, soil exposure and heating	Fuel loading data (fuel models work fine), stand structure and composition
FEIS (Fire Effects Information System)	Accesses information on effects of fire on plants, animals, and ecosystems	Nationwide	Data General AOS/VS; program is self-contained	Information on fire effects tailored to user's needs	None

Wildlife Habitat Models

Model Name	Applications	Geographic Area of Use	Hardware & Software Systems	Outputs	Vegetation Inputs
HSI (Habitat Suitability Index Models)	Evaluates habitat species by species	Nationwide	DOS; self-contained program	Index of suitability for each of several habitat components	USFWS cover types
HEICALC/HEIWEST (Elk Habitat Effectiveness Index)	Measures elk habitat effectiveness	Oregon and Washington	DOS; self-contained program; UTOOLS can generate input directly	Cover and forage indices for elk habitat	Stand data: cover type, density, DBH
HIDE2	Predicts hiding cover for elk	No geographic restrictions	DOS or Data General AOS/VS; self-contained program	Percent hiding cover at 200 feet from stand	Tree density and diameter
HIDE2X	Calculates hiding cover for any animal	No geographic restrictions	Data General AOS/VS; self-contained program	Mean hiding cover values	Diameter and density of tree stems, crowns, shrubs, clumps, etc.
ELK COVER	Determines security cover for elk	No geographic restrictions	DOS, UNIX, or AOS/VS; self-contained program	Percent cover for elk	Stand inventory data or PROGNOSIS output
R2 HABCAP (Habitat Capability Model)	Determines capability of area to support wildlife populations	Rocky Mountain Region	Data General AOS/VS; self-contained program (PC version runs on QuattroPro)	Habitat index value (from forage and cover indices) and estimated supportable population	Cover type and structural stage (from Stage II inventory)
WESTWILD	Measures habitat capability for management indicator species	Southwest Region	Data General AOS/VS	Habitat capability indices and potential number of individuals supported per acre	Acres by structural stage and tree species cover
HABSIM	Provides quantitative analysis of habitat capability	Southern Region	Data General AOS/VS; Oracle database package	Maximum potentially supportable number of animals per species	From CISC stand data: forest type and age class
SE ALASKA HABCAP	Uses GIS to estimate habitat capability for 13 management indicator species	Southeast Alaska, Tongass National Forest	Data General AOS/VS; Arc/Info	Habitat index values and potentially supportable populations	Habitat-related stand variables (cover, age) are accessed through Arc/Info
CALWHRS (California Wildlife Habitat Relationships System)	Determines habitat suitability for 643 terrestrial vertebrates	California	DOS; self-contained program, or could use dBase IV	Separate indices for cover, forage, reproduction; arithmetic or geometric means	Source is Region's timber database - cover type and structural stage.
HABSCAPES (Habitat Analysis of Landscapes)	Assesses habitat distribution at landscape scale	Pacific Northwest (Mt. Hood National Forest initially)	DOS; Paradox for DOS	Spatial arrangement of areas of suitable habitat for functional guilds of species	Community and structural stage distribution, from Mature and Overmature (MOMs) data
BIRDHAB	Uses spatial and tabular data to assess habitat for forest-dwelling birds	Southern Region	UNIX; Arc/Info, Oracle, CISC Oracle	Qualitative assessments of habitat; Oracle queries allow user to specify form of output	Forest type and condition class, obtained from CISC database
ICE (Incremental Cumulative Effects Analysis)	Determines effects of human impacts on grizzly bears	Greater Yellowstone Ecosystem (MT, WY, ID, WA)	DOS; Oracle, QEMM Memory Manager	Habitat effectiveness and mortality risk index for grizzly bears	Not specified; inputs on human alterations require extensive database and spatial data
GROWILD	Analyzes effects of management activities on habitat	California (works with CALWHRS)	DOS; self-contained computer program	Habitat suitability values, acres of optimal + suitable habitat, changes in seral stages.	Land type, successional path, cover type and structural stage
OWL (Spatially-explicit simulator for northern spotted owl)	Simulates individual owl dispersal and analyzes spatial distribution of spotted owl habitat	Pacific Northwest and California	DOS; Arc/Info or MOSS	Spatial arrangement of owl habitat and population probabilities	GIS vector data on stand structure and location
RAMAS/GIS	Links spatial habitat suitability data with metapopulation model	No geographic restrictions	DOS; GIS data in ASCII form	Population viability analysis (risk of extinction, time to extinction, chance of recovery, etc.)	USFWS cover types for HSI analysis

Hydrology/Sediment/Fish Habitat Models

Model Name	Applications	Geographic Area of Use	Hardware & Software Systems	Outputs	Vegetation Inputs
WRNSHYD (Hydrological portion of US EPA WRENSS Manual)	Estimates effects of silvicultural activities on annual water yield	Nationwide	DOS; self-contained computer program	Annual water yield	Basal area (or Leaf Area Index in rain-dominated areas)
HYSED (R2 Water and Sediment Yield Model)	Estimates water and sediment yield from vegetation management	Rocky Mountain Region	DOS; self-contained computer program	Water yield and sediment yield	Basal area; timber type, past and planned harvest
WATSED (Water and Sediment Yield Model)	Estimates water and sediment yield from ground-disturbing activities	Northern Region	DOS; dBase IV is preferred to house the 11 external files needed to support the program	Changes in water and sediment yield	None specified
BOISED (Boise and Payette NF Sediment Yield Model)	Estimates sediment yield from road construction, timber harvest, and fire.	Intermountain West (Idaho Batholith)	Data General AOS/VS; self-contained program	Tons/acre sediment produced under different management alternatives	Acres of harvested areas and method of harvest
NEZSED (Nez Perce NF Sediment Yield Model)	Predicts effects of logging, roads, and fire on sediment yield	Nez Perce National Forest	Data General AOS/VS; Oracle database manager	Annual sediment in tons/square mile	Harvest acres and fire acres
WEPP (Water Erosion Prediction Project)	Predicts soil erosion from road-building	No geographic restrictions	DOS; any Text Editor function	Average annual soil loss/deposition on hillslope points; sediment delivery to waterways	Management activity parameters
WATBAL	Cumulative effects sediment model for defining slope stability of watersheds	Intermountain West, primarily	Data General AOS/VS; program is self-contained	Natural and accelerated sediment, linked to geomorphic threshold of watershed	None specified
IMPACTS (Watershed Impact Assessment Model)	Addresses effects of silvicultural activities on water quality and fisheries	Southern Region	DOS and Data General AOS/VS; program is self-contained	Sediment yield (as surrogate for cumulative impacts)	None specified
SEDROUTE	Assesses changes to erosion, sediment yield, and water yield from proposed projects	No geographic restrictions	Data General AOS/VS; program is self-contained	Tables of erosion, sediment yield, and water yield by map unit	None specified
SHADOW (Stream Temperature Management Program)	Estimates maximum stream temperature for stream reach or basin	Used in Pacific Northwest, Idaho, and California	DOS (non-Windows); LOTUS 123	Amount of unshaded stream; 5-day maximum summer stream temperature	Percent tree overhang, tree height, shade density, tree-channel distance
WOODY DEBRIS MODEL	Estimates natural rates of input of large woody debris to stream channels	No geographic restrictions	DOS; self-contained program	Time trajectories of probabilistic woody debris loading rates	Riparian stand density and height distribution; tree-fall probability distributions

Recreation and Scenic Quality Models

Model Name	Applications	Geographic Area of Use	Hardware and Software Systems	Outputs	Vegetation Inputs
INFRASTRUCTURE	Recreation management database	Nationwide	Data General AOS/VS; Oracle database manager	N/A	Unknown as of publication
SMS (Scenery Management System)	Provides framework for inventory, analysis, and management of scenery	Nationwide	UNIX; Arc/Info (Kisatchie prototype)	Spatial layout of areas of Scenic Attractiveness, Scenic Integrity	Forest type, age, species, acres, [Kisatchie NF prototype used CISC (R-8) database]
NEWPER (New Perspectives)	Graphically models visual perspective of management activities	No geographic restrictions	DOS; self-contained program	Simulation of visual perspective from user-defined vantage points	None specified; general areas of forest cover
VISQUAL (Visual Quality Model)	Scenic quality evaluation	No geographic restrictions	DOS; self-contained program	User queries define output	None specified; general areas of forest cover